

# Conceptual Feasibility Study I-10 Deck Park Proposal

Prepared for  
City of Tucson

February 2, 2006

## EXECUTIVE SUMMARY

The purpose of this feasibility study is to provide the City with a sufficient level of understanding of the costs, impacts, and other implications likely to be encountered under this particular proposed deck park concept. Key findings are as follows:

1. From an engineering perspective, this particular proposal is technically feasible. Our review of roadway geometrics, structural requirements, drainage, maintenance of traffic, and other technical aspects has not uncovered any engineering issues that would prevent this project from going ahead.
2. This particular deck park proposal is estimated to cost \$285 million more than ADOT's \$89 million current plan.
3. Construction of the deck park concept will take approximately five and an half years to complete.
4. Updated environmental documentation will be required, either in the form of an Environmental Assessment (EA) or possibly an Environmental Impact Statement (EIS). An EA would require about two years to complete, and an EIS an additional year. Either would be accomplished concurrently with design and other activities, however, and not expected to delay the start of construction.

A more detailed summary of key points and findings follows.

## SUMMARY OF KEY POINTS AND FINDINGS

The elevated freeway currently divides the downtown area presenting a significant obstacle to the revitalization effort. Lowering the freeway would remove that physical barrier and promote the goals of redevelopment of the downtown area.

This study has been accomplished in 30 days and is limited in level of detail. It does, however, provide a sufficient understanding of costs and issues to make an informed decision of whether to further pursue the deck park proposal. If the decision to proceed is made, the approaches discussed here would be further refined and plans and reports will be prepared for review and comment by the City of Tucson, ADOT, FHWA, and other entities. Public involvement will be an integral part of subsequent planning and design efforts. A summary of key points and findings is presented here:

### Freeway Geometrics

- o Initial design work indicates that the deck park proposal can be constructed in conformance with current ADOT geometric standards.
- o The lane configuration of ADOT's current design has been held for the mainline, frontage roads, and ramps to avoid introducing capacity or operational issues for the freeway. Similarly, the footprint of the completed improvements will be contained within the current right-of-way.
- o The altered mainline profile will extend approximately from St. Mary's Road to 22nd Street.
- o A minimum of 16'-6" clearance will be provided.
- o The profiles of the deck park and of Congress Street, Clark Street and Simpson Street over I-10 remain near the elevation of the surrounding terrain.

### Structures

- o Conceptual analysis has been performed to determine initial sizing and costs of the deck park structure and bridge crossings for Congress, Clark, and Simpson Streets. The deck park structure will span the frontage roads as well as the mainline freeway.
- o The most economical superstructure system would be cast-in-place post-tensioned concrete box girders built on soffit fill. Abutments and center piers would be placed on drilled shafts.
- o A deck park structure approximately 600' in length has been evaluated here, extending from approximately 900' south of Congress to Clark Street. The northern limit is established by the clearance requirement over the two freeway ramps and frontage roads south of Congress.
- o Approximately 240,000 square feet of retaining wall will be needed to support the lowered roadway section. Two plausible "top-down" construction approaches have been considered, soil nailing and drilled shafts. Drilled shafts have been proposed here to avoid conflicts with existing utility corridors.

### Drainage

- o Several offsite drainages cross the reach of I-10 to be lowered. These would be handled in one of two ways -- through inverted siphons under the depressed roadway or through the deck or separate bridge structures over I-10.
- o These offsite flows can be placed in underground culverts upstream and downstream of I-10 to maximize the redevelopment potential, or in landscaped open channels to enhance visual quality and mitigate the loss of vegetation.
- o A new storm drain approximately 72" in size would be extended from Congress northward beyond the depressed section to deal with the relatively small flows in Congress and Alameda.
- o Pavement drainage would be collected in a vault under the freeway, from which it can be pumped over time. This approach was found previously to be more cost-effective than directly discharging either by pumping or a gravity outflow storm drain. This approach also provides a suitable means for treating runoff.
- o A previous study indicated that a 100-year flow in the Santa Cruz River would not enter the depressed section but that a 100-year flow in Tucson Arroyo could. Relatively modest construction of berms or floodwalls would resolve this condition.
- o Previous evaluation of groundwater effects indicated that placing geotextile fabric beneath the roadway pavement and behind the retaining walls will effectively deal with hydrostatic forces. This system can also be used with side drains to collect ground water infiltration and carry it to the pavement drainage system.

### Utilities

- o Relocation of conflicting water and sewer lines will be required. The proposed I-10 crossing of a proposed 60" interceptor sewer at Alameda Street will be moved northward to avoid the lowered profile.
- o Existing utility corridors along the east and west I-10 right-of-way will be largely undisturbed. The utilities in the corridors include TEP conduits, Qwest Communication conduits, Southwest Gas lines, and Freeway Management System (FMS) conduits owned by ADOT. Relocation of short reaches to avoid drainage and ventilation facilities may be required.
- o Private utility crossings that would be impacted include two telephone lines, a 48" steel-cased underground electrical substation feed, a fiber optic telephone in a 5" casing, and an 8" high-pressure natural gas line.

### Environmental Clearance

- o An assessment of potential environmental impacts has been made by reviewing previous documentation and through discussions with City, ADOT, FHWA, and other knowledgeable professionals.
- o No "fatal flaw" issues for the deck park proposal have been identified.
- o Updated environmental documentation will be required, either in the form of an Environmental Assessment or an Environmental Impact Statement .
- o An EA would require about two years to complete, and an EIS an additional year. Either would be concurrent with design and other activities and would not delay the start of construction however.

### Construction Sequencing and Traffic Control

- o Temporary detours would be constructed outside of and parallel to the ultimate I-10 footprint to carry mainline traffic through much of the construction. This will allow the bulk of construction activities including environmental clearance, excavation, roadway and drainage construction, and construction of the deck park structure and other bridges, to occur in a single phase. It will not be necessary to detour mainline traffic onto local streets.
- o Detour capacity would probably be limited to three lanes.
- o The detours would include temporary overpasses at Congress Street and 22nd Street to allow local traffic to cross I-10 during construction.
- o The detours would be located in existing right-of-way and temporary construction easements.
- o The general phases and their durations are indicated in the table shown here.

Phase	Work to be Completed	Traffic Impact	Duration
1	Construct Detours	No impact to mainline traffic except ramps at Congress Street and 22nd Street are closed. Frontage roads closed.	12 months
2	Construct mainline and most of frontage roads and ramps	Mainline traffic on detours. See Section 8 for discussion of local circulation and access.	40 months
3	Remove detours. Complete frontage roads and ramps	Mainline open to interstate traffic. Frontage roads and ramps opened as they are completed.	14 months

### Other Considerations

- o Other than compliance with the National Fire Protection Association (NFPA) Code for tunnel construction and fire protection, there are no regulations or design criteria in place addressing design issues in the covered section.
- o The transport of hazardous cargo through Tucson on I-10 is not currently restricted. That would not change as a result of the deck park construction unless ADOT so designates. There are no federal requirements disallowing hazardous material from covered roadways. Covering a relatively short portion of I-10 may not trigger it being restricted.
- o If hazardous cargo is restricted, alternative routes exist such as through Gila Bend and Ajo via SR-86 and SR-85 as oversize loads are currently directed.
- o The deck park proposal presents no special issues regarding illumination and signing.
- o The need for artificial ventilation will be evaluated and a fire protection system including standpipes, emergency access, and a fire suppression system will be provided.
- o Periodic maintenance will include testing and repair of the drainage, lighting, ventilation, and fire suppression systems.

### Traffic Circulation

- o Ultimate freeway operation is not expected to be altered by the deck park proposal as the number and configuration of lanes does not differ from that of ADOT's current plan.
- o During construction, mainline traffic volumes will be greater than under ADOT's current plan due to all traffic being constricted to the three lane detours. The Congress Street and 22nd Street crossings of I-10 will remain open during the construction.
- o During construction, access to adjacent parcels from the frontage roads needs to be modified.

### Estimated Cost

- o The cost increase resulting from the deck park proposal is estimated here to be \$285 million. The total cost of lowering I-10 has been found to be \$374 million, and \$89 million the comparable cost of ADOT's current design.
- o Some refinement in this estimate can be expected as more detailed design occurs.

### Implementation

- o A follow-up effort of more detailed analysis and evaluation is needed to better define approaches and costs. This would also provide initial plans and reports that ADOT, FHWA, and City staff can review and provide comment on. Public outreach would be included in this effort.
- o Construction of the deck park option is currently estimated to require five and a half years to complete.

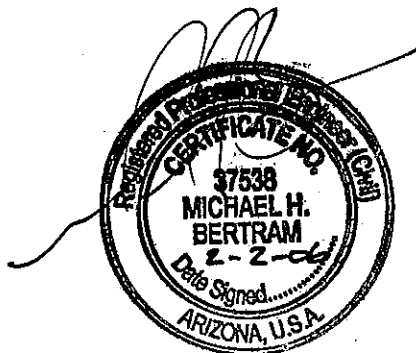
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Prepared for  
City of Tucson

By

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February 2, 2006



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- A. Construction Schedule
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## SECTION 1. INTRODUCTION

The purpose of this report is to document the results of the initial feasibility analysis performed to provide information regarding cost and feasibility of lowering I-10 through the downtown area. The elevated freeway currently divides the downtown area. A key element would be a deck park spanning a portion of the freeway including the frontage roads, and this concept is being referred to as the "deck park proposal".

The benefits of this proposal would be dramatic. The visual barrier between the two sides of the freeway would be removed, and the noise in the surrounding area would be reduced. The deck park would allow unfettered access between the east and west sides of the freeway, creating a physical and psychological connection that would otherwise not be possible.

The intent of this study is to provide an initial indication of the engineering feasibility, cost, and time frame to design and construct the deck park proposal.

### BACKGROUND

The notion of depressing I-10 through downtown was first raised in 2000. At that time, the City studied the feasibility of undergrounding I-10 from a point north of Speedway to south of 29th Street. The proposal first considered would have placed the roadway in a tunnel deep enough to avoid disrupting existing utilities and cross drainage. The tunnel would have been three miles in length. The cost found at that time was \$1.4 billion, and a number of other potentially insurmountable issues were identified. The results of that study were presented to the City as a letter report dated January 26, 2001.

The cost and impacts of that approach were clearly untenable, and the City then considered a more modest proposal of depressing I-10 from south of St. Mary's Road to north of 22nd Street. A profile of sufficient depth to allow for placement of top soil for planting, and a second profile approximately five feet higher were evaluated. The costs determined for those approaches were \$170 million and \$160 million respectively. A deck was not considered but extra width for the bridges crossing the depressed freeway was provided including 850' width for Clark Street. The results of that study were provided to the city as a letter report dated February 12, 2001.

That report was forwarded to ADOT who responded with several comments and concerns. In response to that, the more detailed study was performed as documented in a report dated January 4, 2002. Accompanying that report were initial detailed geometrics developed to ensure that then-existing geometric standards could be met. Other issues such as draining the depressed roadway, dealing with cross-drainage, groundwater infiltration and buoyancy, were also addressed.

Preliminary sizing and costs for bridge crossings at Congress Street, Clark Street, and Simpson/Mission Lane were determined, though the extra width was no longer included. A pedestrian structure was also included between Congress and Clark. A construction sequencing and traffic control scheme was developed to determine cost and duration, and to show that a viable

scheme was even possible. The increased cost of depression over that of the currently planned improvements was estimated at that time to be \$55 million. The inclusion of the deck park and the lowering of the frontage roads along with the mainline make the deck park proposal substantially more complex than the earlier proposal.

ADOT in the mean time has proceeded with its program of I-10 improvements. To date, new frontage roads have been constructed and mainline improvement plans are complete. Under ADOT's current plan, the mainline would remain elevated.

#### INTENT OF THIS STUDY

This study is intended to provide the City of Tucson with an initial indication of the cost and technical feasibility of the deck park proposal. It has been accomplished in 30 days and is necessarily preliminary in detail. It does not include plans or other formal deliverables other than this report. This information does provide sufficient understanding of costs and issues for making an initial determination of whether to further pursue the deck park proposal. Should the decision be made, options for reducing cost, impacts, and schedule will be explored, and initial plans and reports addressing the range of issues prepared.

## SECTION 2. ROADWAY GEOMETRICS

To ensure that the I-10 mainline, frontage roads, and ramps can be physically configured to accommodate the deck park proposal while still meeting current ADOT standards, preliminary geometrics have been developed. Key elements are as follows.

### OPERATIONAL ASPECTS

The lane configuration of the current plan has been retained here to ensure that no operational or capacity changes would be effected under this deck park proposal. The number of travel lanes, lengths of turning lanes, weaving lengths, and so forth are unchanged. The plan and profile developed here is shown schematically in Figure 1 and typical section in Figure 2.

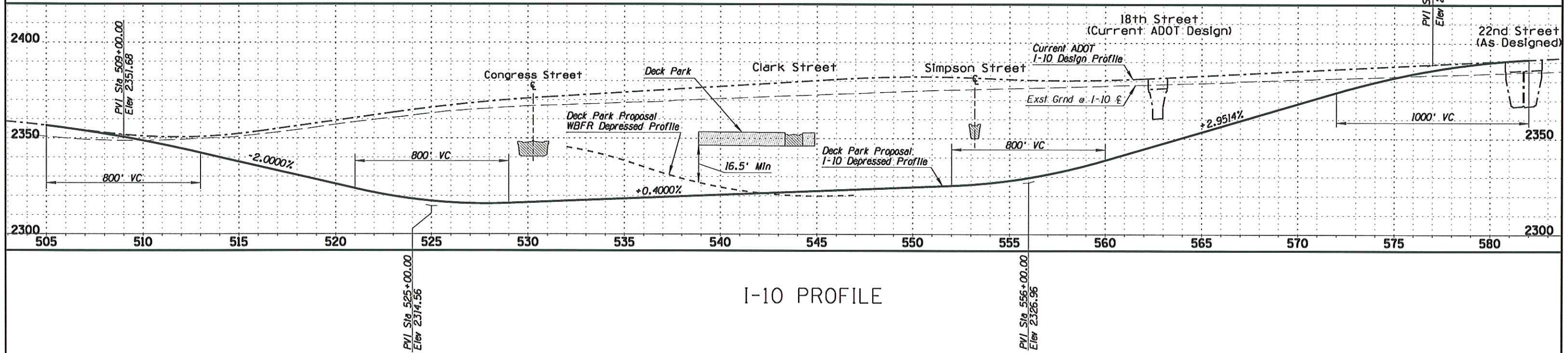
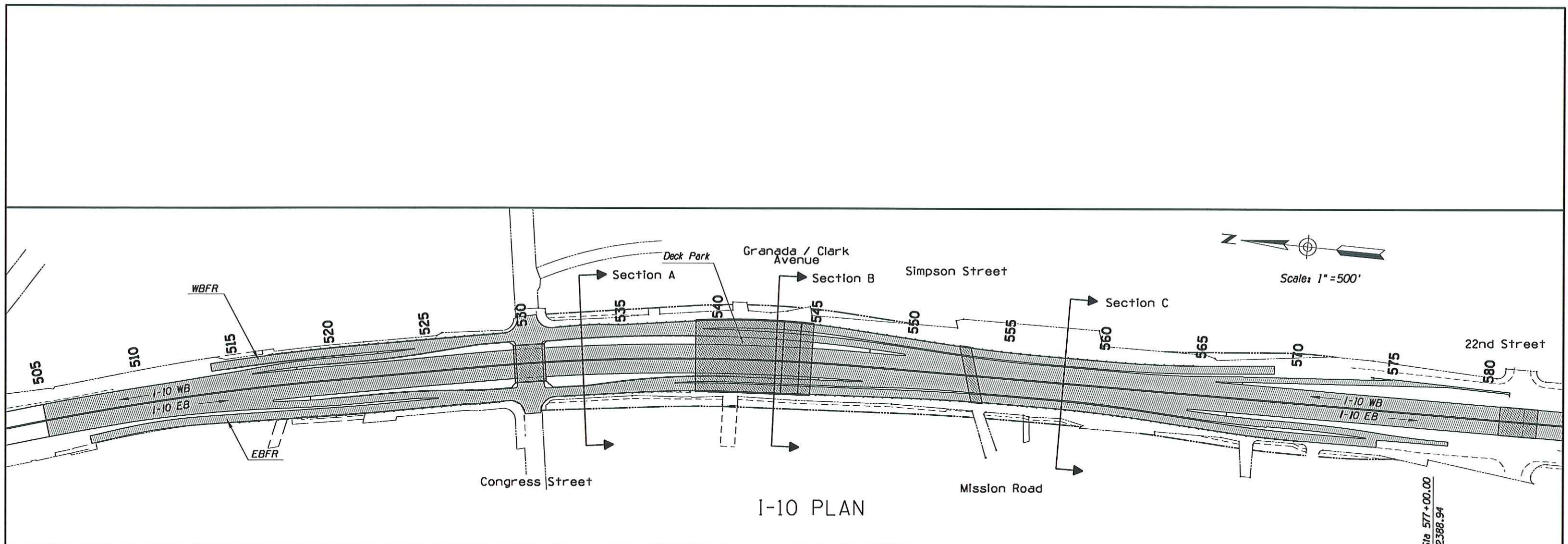
### HORIZONTAL GEOMETRICS

The horizontal geometrics are largely the same as well though several changes were needed to accommodate the structure and the lowered profile. The mainline horizontal control line is unchanged. The possibility of shifting the alignment has not been explored.

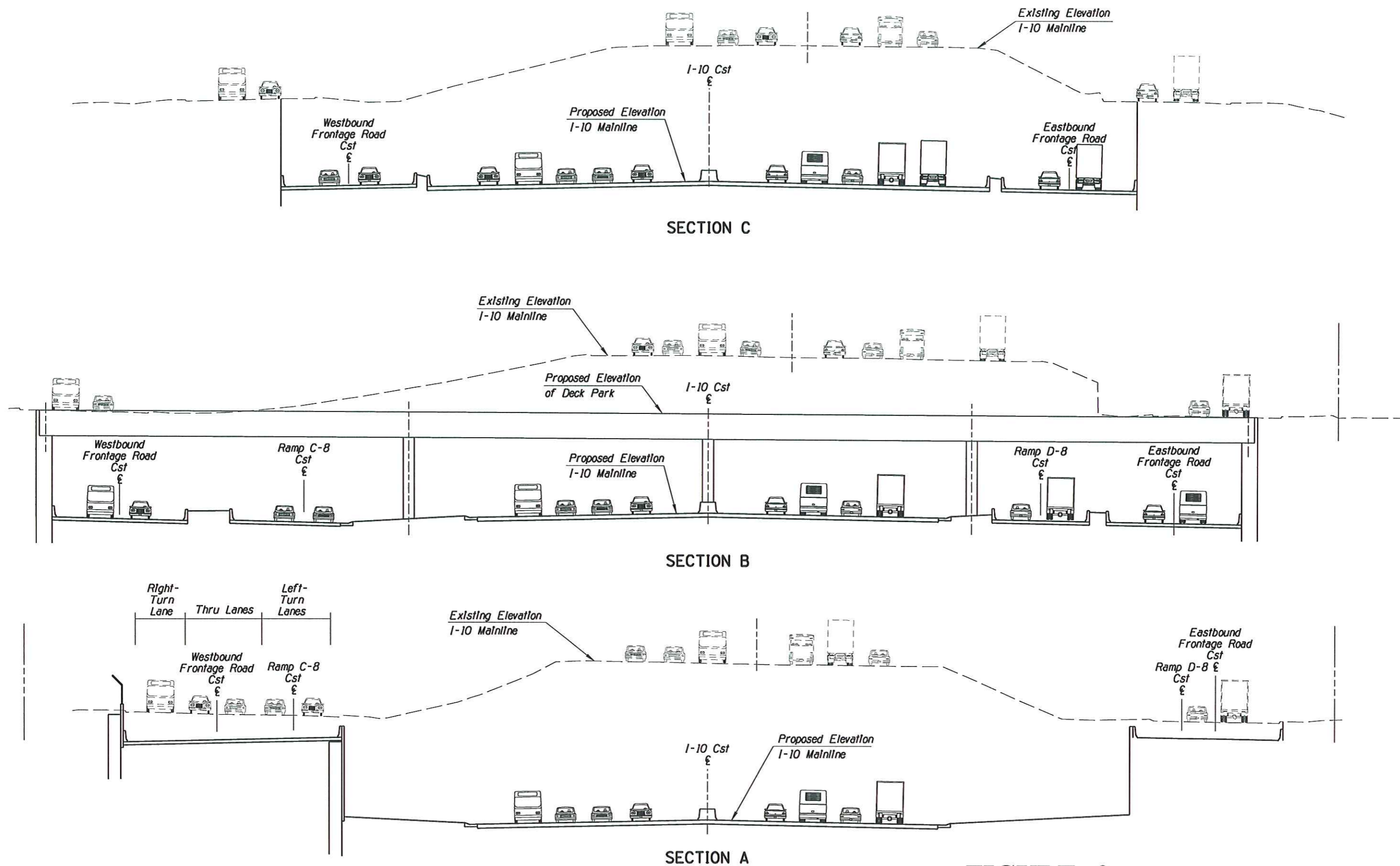
The I-10 median barrier rail has been widened from the standard width of 2' to 6' to allow bridge piers to be constructed along the centerline. The mainline travel lanes and ramps have been shifted 2' outward to accommodate this. Since the frontage roads will also pass under the deck park structure, they have been shifted inward toward the mainline between Congress and 22nd Street to shorten the span of the structure.

### VERTICAL GEOMETRICS

Vertical geometrics are, of course dramatically altered under the deck park proposal. The mainline profile developed for the 2002 study has been altered to meet updated requirements for minimum and maximum longitudinal slope (0.40% and 3.00% respectively). The new mainline profile begins at Station 505+00 just south of St. Mary's Road. It transitions through an 800' crest vertical curve to a relatively gentle downward slope of 2.32% to the bottom of the depression. The lowest point of the profile occurs about 200' before reaching the Congress Street bridge. It then rises through the depression at 0.40% for about one-half mile before beginning its rise back to the elevated profile at 2.95%. It returns to the elevated profile at Station 582+00 at 22nd Street. All of the vertical curves are 800' or longer and provide stopping sight distance for more than 70 mph.



**FIGURE 1**  
**Schematic Plan-Profile of I-10 Deck Proposal**



**FIGURE 2**  
Roadway Typical Sections

This profile provides a minimum of 16'-6" clearance under the new bridges at Congress Street and Simpson Street/Mission lane crossings, and under this proposed deck park structure. The superstructure thickness used is based on preliminary design calculations. As the structural design is refined, it may be possible to raise this profile somewhat.

Ramp profiles have been revised as needed to meet the lowered mainline profile. It will also be necessary to lower portions of the existing frontage roads north of Congress to meet the ramp profiles due to limitations on the lengths of these ramps. Under the elevated scenario, it was necessary to raise the frontage road profiles for similar reasons.

The maximum ramp grade is 3.86%. All ramp vertical curves are 400' or longer and have a design speed greater than 50 mph. The clearance requirement over the ramps and frontage roads south of Congress Street control the northern limit of the deck park.

The new frontage road alignments and profiles are also based on 50 mph design speed. The maximum grade is 4% and super-elevation is 6%. The maximum frontage road grade approaching Congress Street is 3.0% for at least 400'.

The profiles of Congress Street, Clark Street and Simpson Street crossing over I-10 have not been developed in detail but have been assumed to be near the elevation of the surrounding terrain. The profile along the deck park has likewise been established to approximately match existing ground on either side. The proposed profiles all provide sufficient clearance under these structures based on preliminary structural designs as discussed in the following section.

#### RIGHT-OF-WAY

No new permanent right-of-way will be required to accommodate the geometrics of this particular depressed roadway proposal though as discussed later easements may be needed for pump stations and utility relocation. Temporary easements for detours during construction may also be needed as discussed in conjunction with construction sequencing and traffic control.

### SECTION 3. STRUCTURES

The conceptual design of the structures was based on the American Association of State Highway and Transportation Officials (AASHTO) Standard Specifications for Highway Bridges, 17th Edition, 2002, as well as the Arizona Department of Transportation Bridge Practice Guidelines. Other requirements regarding the covered sections were based on the National Fire Protection Association (NFPA) 502 Standard for Road Tunnels, Bridges, and Other Limited Access Highways, 2004 Edition. The specific loadings used for each structure are listed below:

#### LOAD ASSUMPTIONS

##### Covered Section Loading

*Dead Load 1* -- One foot of landscaping material which could include soil, decomposed granite, brick pavers or a combination thereof with a maximum weight of 138 psf applied over the entire deck surface.

*Dead Load 2* -- 10' x 10' x 5' deep planters spaced at mid-span of each span on the 4 span structure and at third points of each span on the 2 span structure (4 per row). The planters will be placed at 40 feet on center along the length of the deck for both the 4 span and 2 span structures. Thus there will be 4 planters in a row across the width (east-west) of the structure with the rows spaced at 40 feet on center along the length (north-south) of the structure.

*Waterproofing & Protective Covering* -- 12 psf

*Live Loads* -- Public Assembly: 100 psf (not concurrent with truck loading)

*Truck Loading* -- AASHTO HS20-44

*Seismic* -- Seismic Performance Category A

Cross Street Bridge Loading (Congress St., Clark St. and Simpson St.):

*Dead Loads* -- Future Wearing Surface: 25 psf

*Live Loads* -- AASHTO HS20-44 / Interstate Alternate Loading

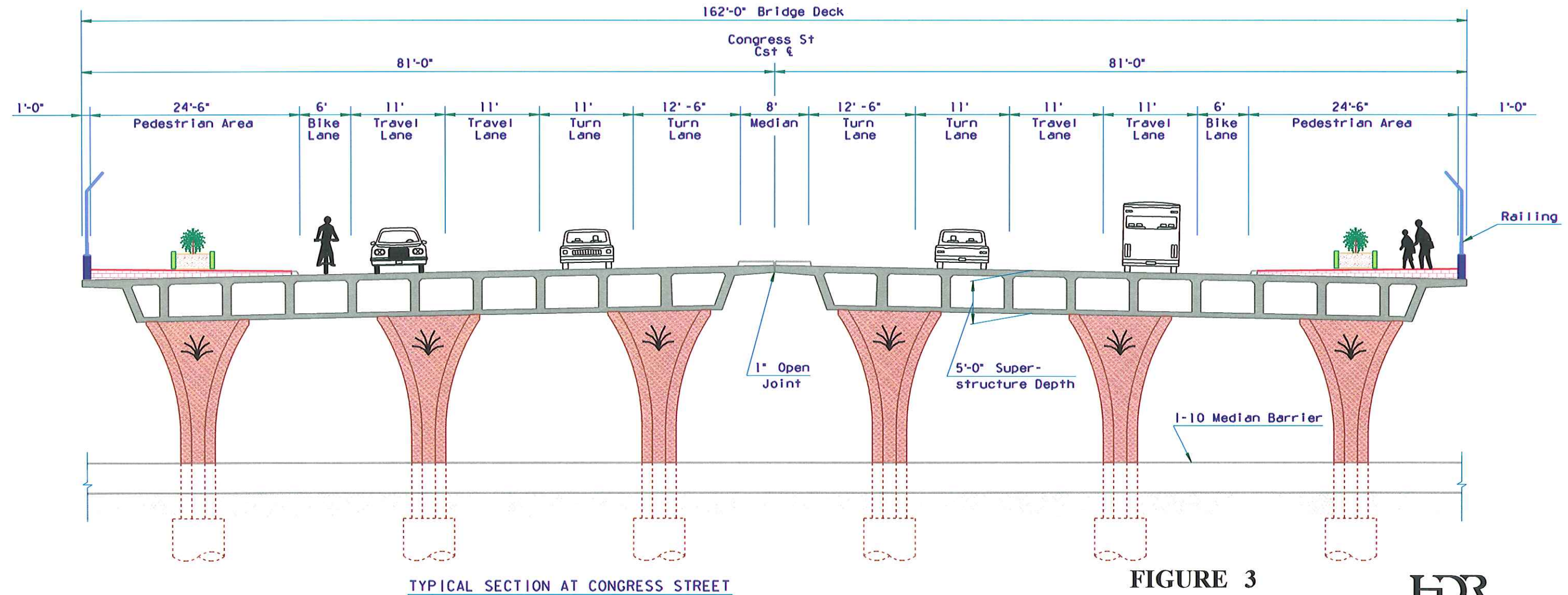
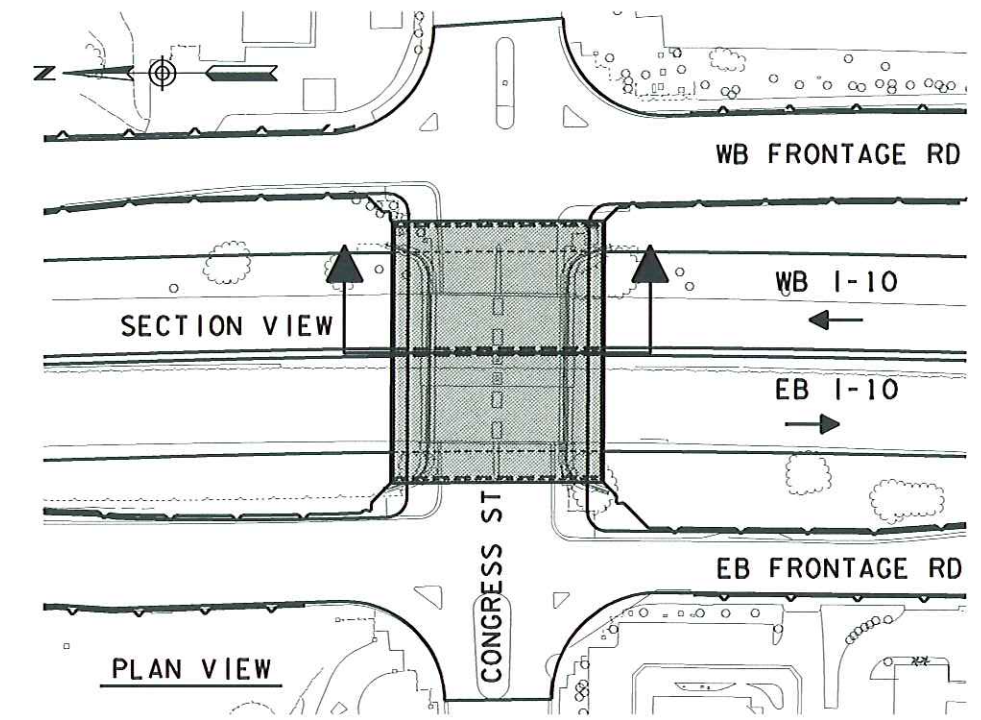
*Seismic* -- Seismic Performance Category A

#### GEOTECHNICAL RESOURCE

The preliminary foundation design has been based on the Final Geotechnical Report by NCS Consultants, LLC dated July 15, 2005 for ADOT's I-10 St. Mary's to 29th Street. Additional consultation was provided by Naresh Samtani of NCS Consultants regarding probable foundation systems for the structures required to lower I-10.

#### CONGRESS STREET BRIDGE

The Congress Street superstructure would consist of 5' deep cast-in-place post-tensioned concrete box girders. For traffic handling purposes, it would be constructed as two structures separated by a 1" longitudinal joint located along the Congress centerline. The superstructure width will be sufficient to accommodate in each direction a 1' concrete parapet with pedestrian bridge fencing, a 24'-6" pedestrian area, a 6-foot bike lane, two 11' travel lanes, and 11' and 12'-6" left turn lanes. There will also be an 8-foot median in the center for a total bridge width of 162'. The overpass will have two spans with a total bridge length of 196'. The center pier will be concrete columns supported on drilled shaft foundations. The abutments will be full-height drilled shaft retaining walls supplemented as required with larger diameter drilled shafts to support the vertical loads from the structure. Figure 3 shows the typical section anticipated for this structure.



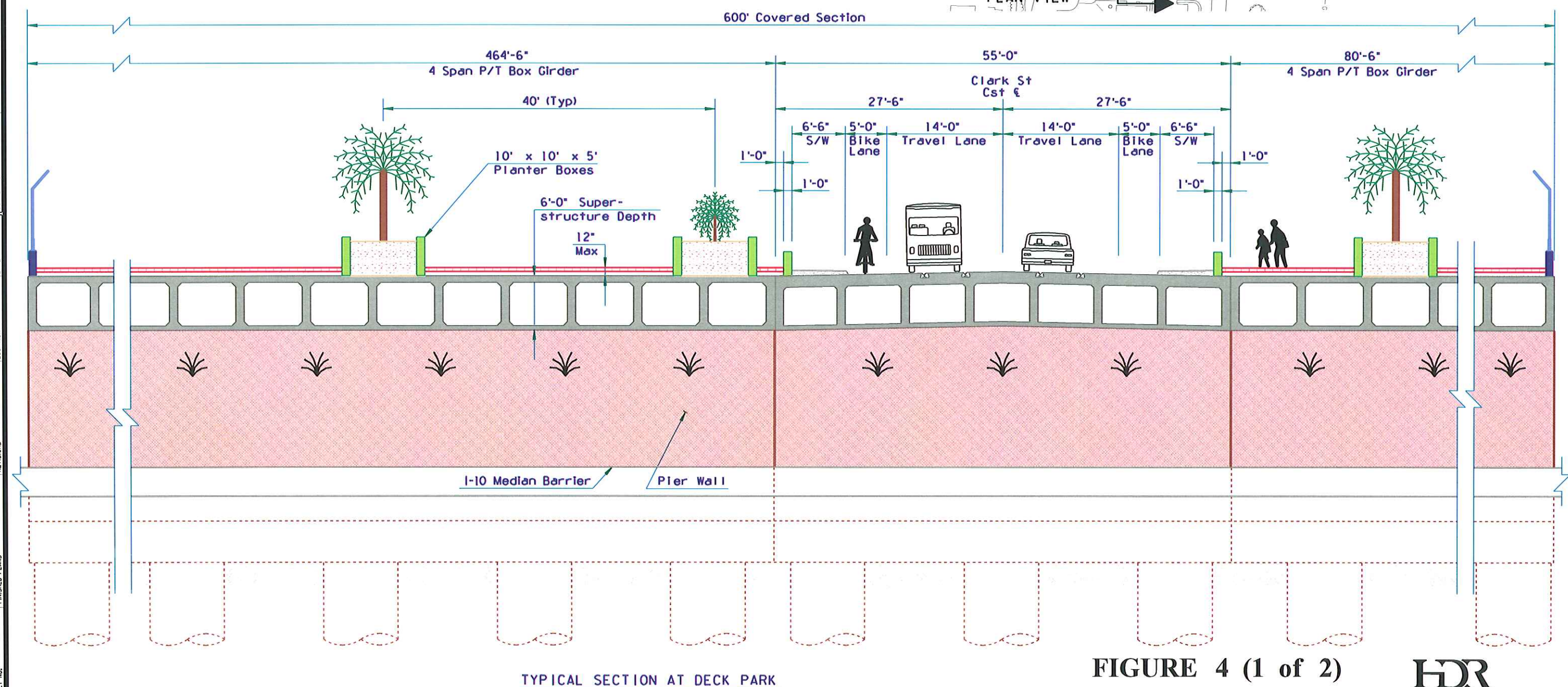
**FIGURE 3**  
**Typical Section Congress Street Bridge**  
**HDR**  
**HDR Engineering, Inc.**

### DECK PARK STRUCTURE

An important element of the deck park proposal is connectivity between the two sides of I-10 that will be afforded by construction of a deck structure spanning the freeway. The northern limit of this structure is as close to Congress as the profiles of the freeway ramps and frontage roads permit.

The deck park configuration evaluated here is approximately 600' in length (in the north-south direction of the freeway) extending to the proposed bridge at Clark Street. A relatively efficient four-span structure is possible in that reach with piers located along the freeway center line and between the ramps and mainline. The maximum span of the four-span structure would be about 114' and the depth of structure 6'. The piers will consist of 4' thick pier walls supported by a drilled shaft cap on 7 foot diameter drilled shafts. The depth of the shafts would vary from 120' to 135'. The abutments will be supported on a drilled shaft retaining wall similar to the retaining walls discussed later, but would be supplemented with larger diameter shafts to support the vertical load of the superstructure.

Two box girder systems were evaluated for the deck park structure -- pre-cast pre-stressed concrete box girders and cast-in-place concrete post-tensioned box girders. The length and weight of the girders precludes the possibility of economically transporting them from off site. For that reason, cast-in-place would be used here.



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#### CLARK STREET BRIDGE

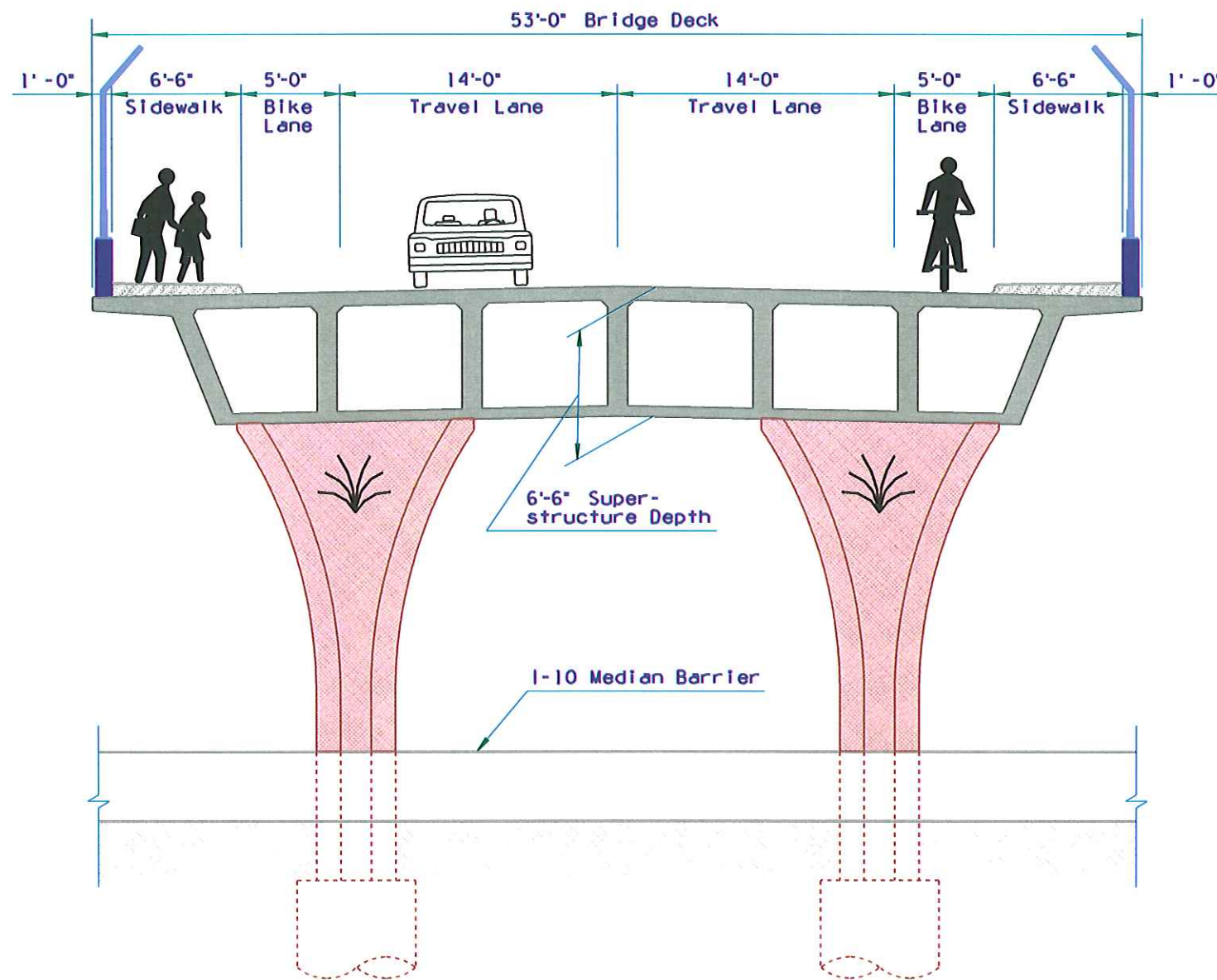
The proposed Clark Street bridge would also be constructed as a cast-in-place post-tensioned concrete box girder structure. It would be adjacent to the four-span deck structure from which it would be separated by an expansion joint. Were the two-span extension adopted, it would be adjacent to the Clark Street Bridge and a similar separation approach would be used.

The superstructure will accommodate on each side a 1' concrete barrier, a 6'-6" sidewalk, a 5' bike lane, and a 14' travel lane for a total bridge width of 55'. The travel lanes would support the proposed modern street car as well as standard traffic loading.

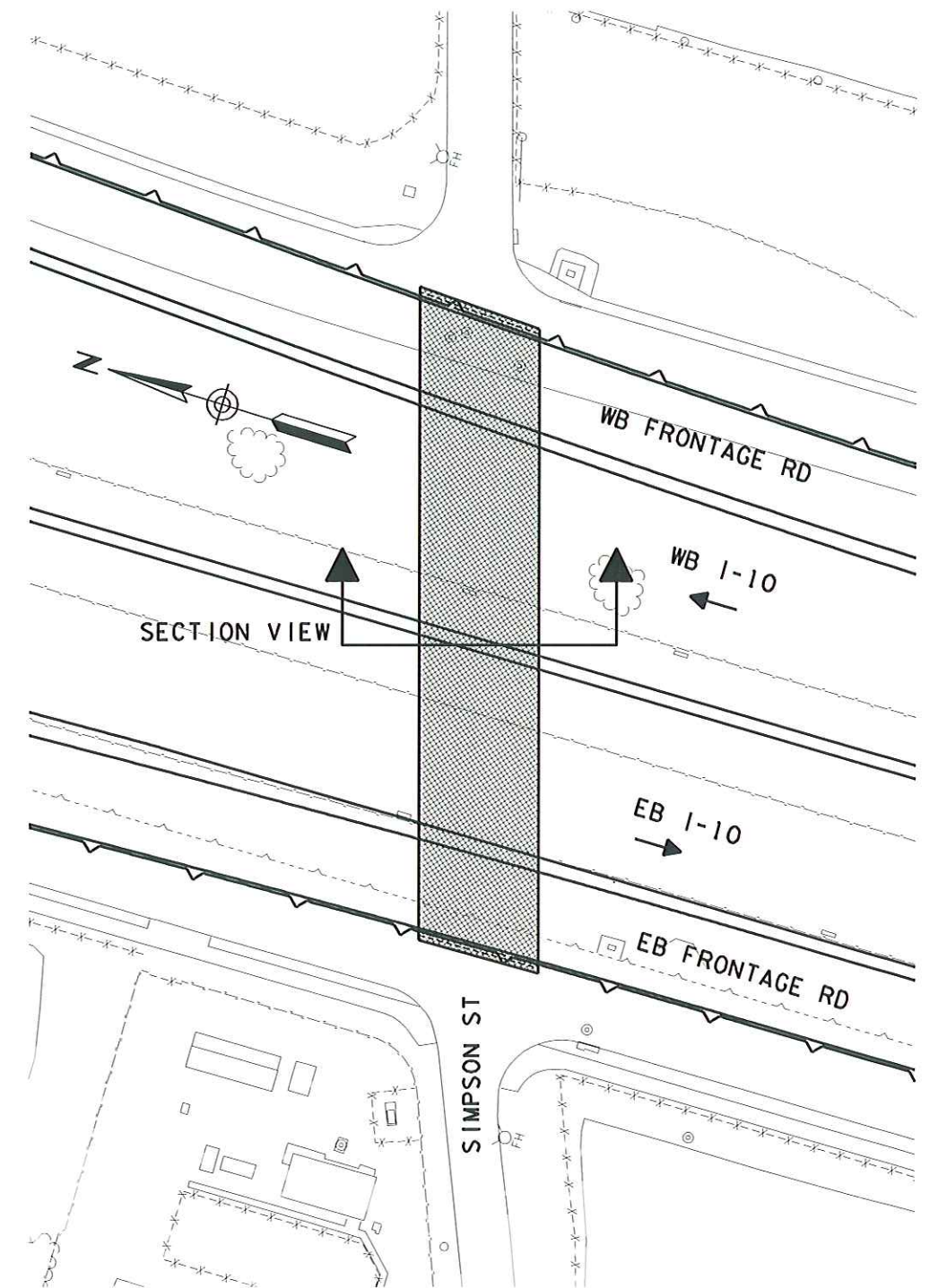
The structure will have four spans for a total length of 390'. The superstructure depth would be 6'. The piers will consist of a 4' thick pier wall supported by a drilled shaft cap on 7' diameter drilled shafts. This typical section is seen in Figure 4 (1 of 2) as part of the deck park structure..

#### SIMPSON STREET BRIDGE

The proposed Simpson Street bridge will be constructed of 6'-6" deep cast-in-place post-tensioned concrete box girders. The bridge width will account for a 1' concrete parapet with pedestrian bridge fencing and 12'-6" sidewalks both sides, two 12' travel lanes, and a 3' median. The total width will be 56'. The overpass will consist of spans of approximately 156' and 144', with the total length of the bridge being 307'. This typical section is shown in Figure 5.



TYPICAL SECTION AT SIMPSON STREET



PLAN VIEW

FIGURE 5  
Typical Section Simpson Street Bridge

### RETAINING WALLS

The proposed lowering of the I-10 mainline and frontage roads will put the roadway surface 25' to 30' below existing terrain, requiring approximately 240,000 square feet of retaining wall. These walls will necessarily be constructed from the top down as the depressed section is excavated. Two retaining wall systems capable of top-down construction have been considered here -- soil nailing and drilled shafts.

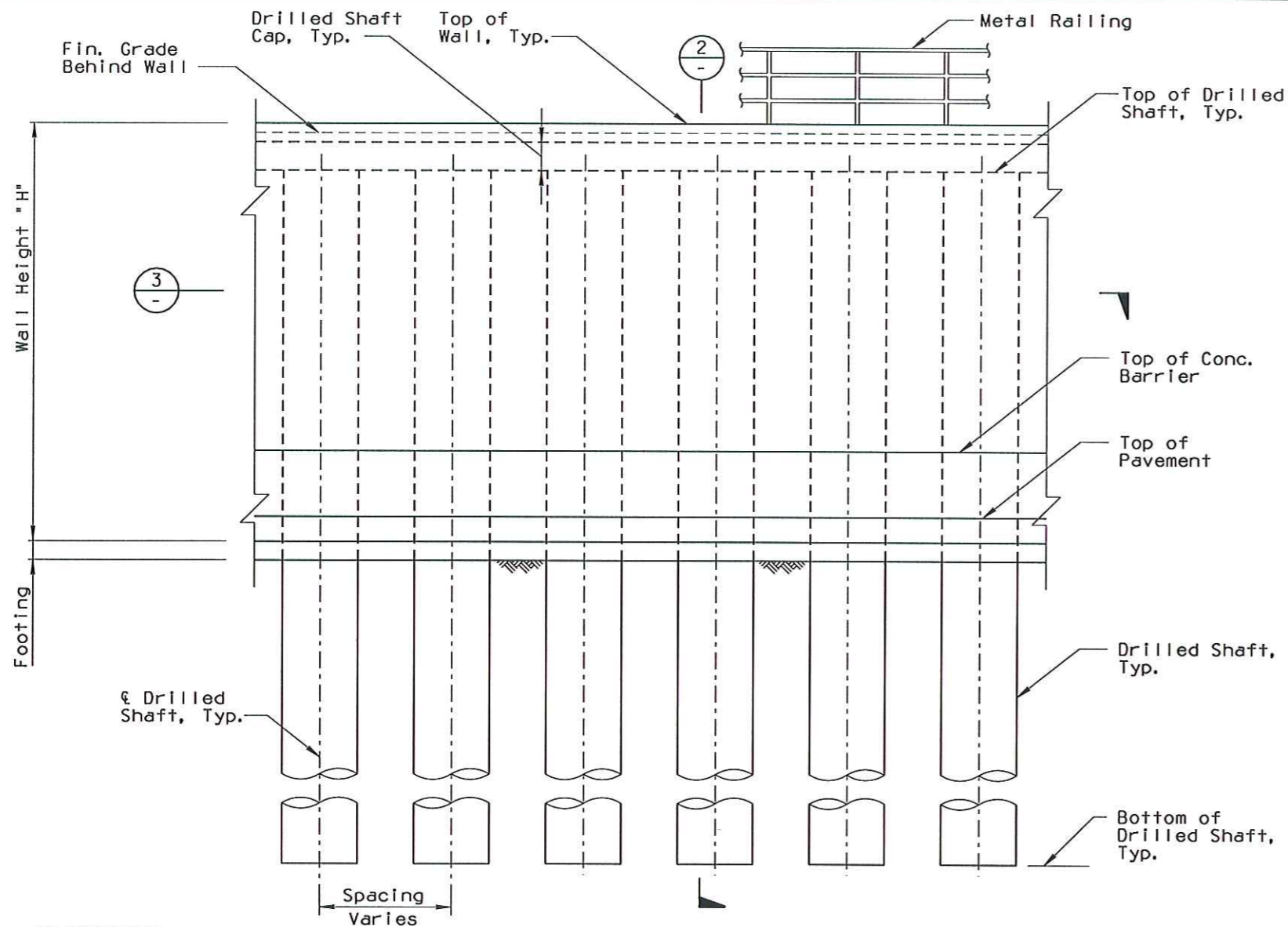
Soil nailing involves excavating a shallow cut and drilling horizontal anchors into the face to be retained. A reinforced shotcrete wall is then attached to the anchors. This process is repeated in downward increments until the full depth of excavation is reached. A face wall is applied once the shotcrete surface is complete.

A drawback to this system in this case is the presence of utility corridors in the area where the anchors would be placed. It would also involve drilling into earth that has not been environmentally cleared. For that reason, the more expensive drilled shaft system has been proposed here. More detailed study may reveal ways to deal with these issues which would realize a cost savings. It is noted, however, that drilled shafts will be used for abutments of the bridges and deck structure.

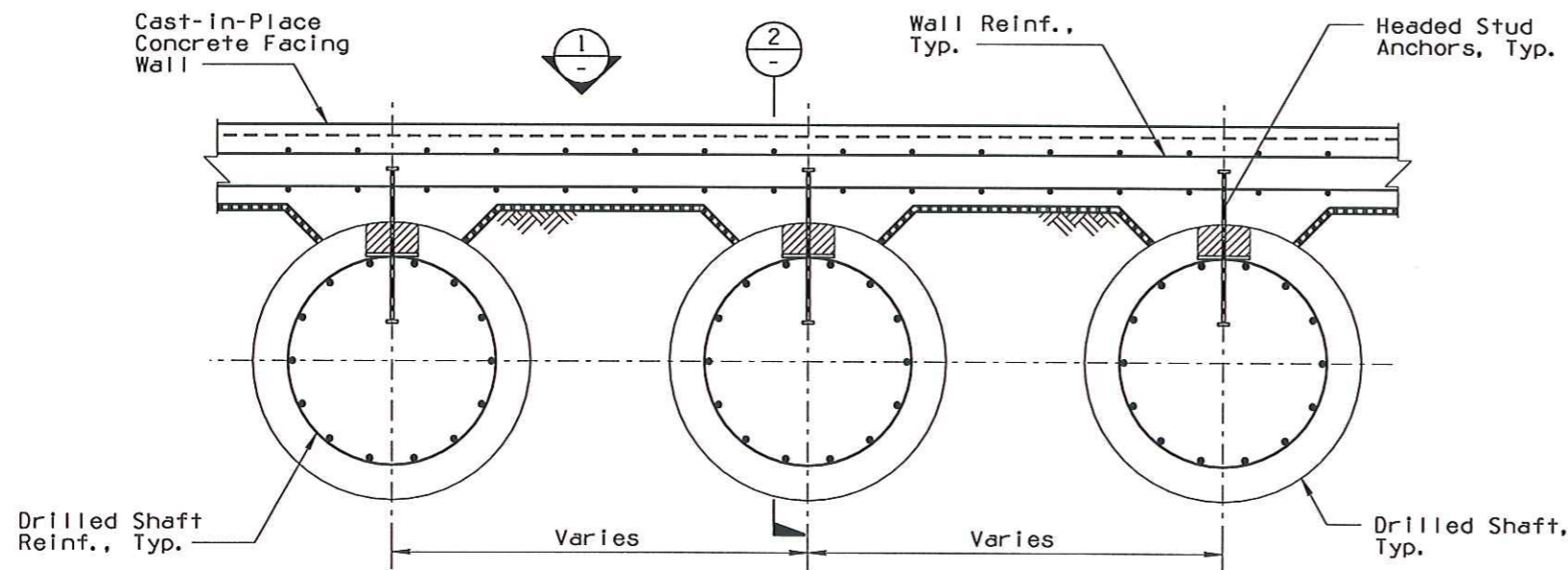
Drilled shaft retaining walls would work well for this project because they can be built from the top down without temporary shoring and without disturbing existing utilities or cultural resources. Drilled shafts are placed along the retaining wall alignment prior to excavation. They are spaced close together to retain the soil behind them as the excavation occurs. Once the excavation is complete, a cast-in-place reinforced concrete facing wall is then anchored to the drilled shafts. The drilled shafts extend below the bottom of the excavation a distance that increases with the height of the wall. For this project, 4' diameter drilled shafts would be used, spaced from 4'-6" to 9' on center on center depending on soil conditions and height of wall. A diagram illustrating the concept of the drilled shaft retaining wall system is provided as Figure 6.

### DECK PARK USE

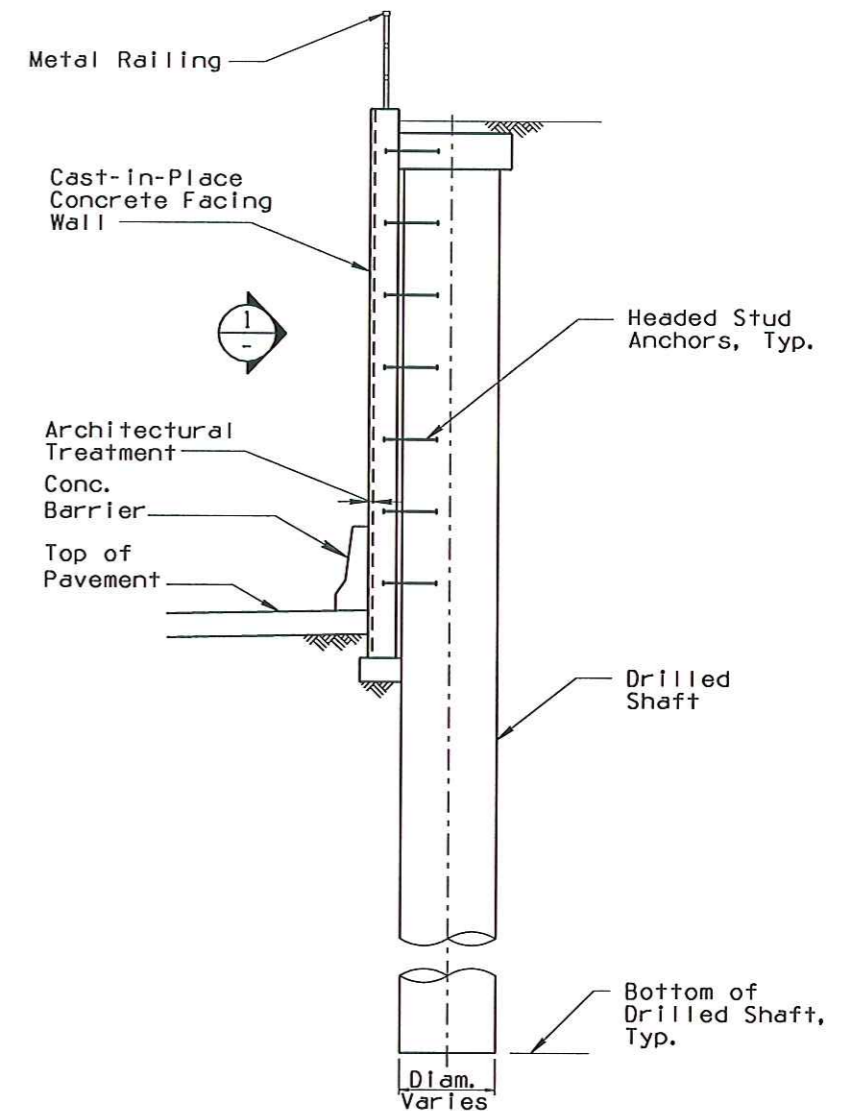
The loading assumptions described earlier for determining the structural requirements of the deck park allow for public assembly, architectural surfacing such as brick pavers, moderately sized trucks and other maintenance vehicles, and intermittent planters of sufficient size for certain trees and other vegetation. It would not support construction of occupied structures.



**ELEVATION**  
Scale:  $\frac{1}{8}" = 1' - 0"$



**SECTION**  
Scale:  $\frac{3}{8}" = 1' - 0"$



**TYPICAL DRILLED SHAFT WALL SECTION**  
Scale:  $\frac{1}{4}" = 1' - 0"$

**FIGURE 6**  
**Drilled Shaft Retaining Wall Details**

## SECTION 4. DRAINAGE

### CROSS DRAINAGE

The 2002 study suggested the use of inverted siphons for carrying cross drainage under the depressed section. That may still be the most viable option though the need to drain the sump once runoff has ceased and the need to convey sediment and debris presents potential design and operational issues. It is noted that such structures are commonly used by the Salt River Project and other entities throughout the western United States, and are a legitimate approach for consideration here.

The deck park structure, however, provides the potential alternative of carrying cross drainage through the structure at approximately the current flow line in much the manner of a standard box culvert. This would eliminate the problematic elements of sediment, pumping, and operation and maintenance as issues, but introduces structural and waterproofing considerations. It is also necessary that the flow be carried across I-10 perpendicular to the freeway, and in the case of 18th Street Wash that the flow be carried northward to the deck.

Carrying cross drainage through the deck has been assumed for this study for determining cost and environmental impact. Further investigation into the siphoning approach should be conducted before finalizing the cross drainage approach.

There are four locations where offsite drainage presently crosses the section of I-10 that would be lowered. A description of these and how they could plausibly be handled is as follows:

*Culvert 1 at Station 514+60:* An existing 48" pipe culvert approximately 1,170' north of Congress will be cleared by the proposed profile and does not need to be addressed for the purpose of lowering I-10. It does not, however, convey a full 100-year storm. The proposal here is to replace the 48" culvert with a 10' x 7' reinforced concrete box culvert (RCBC). That, together with an existing 60" storm drain extending northward to Tucson Arroyo, will provide sufficient capacity for the 100-year flow feeding both Culverts 1 and 2 (as discussed next). The 100-year flow reaching Culverts 1 and 2 is approximately 650 cfs. Of that amount, the 60" storm drain carries about 150 cfs, leaving 500 cfs to be carried under the freeway in the new culvert.

*Culvert 2 at Station 523+65:* An existing 36" storm drain crossing I-10 approximately 660' north of Congress would be impacted by the lower profile, and that conveyance would need to be replaced in some fashion. It is proposed here to divert this flow northward to Culvert 1 in a storm drain approximately 72" in diameter and 950' in length. A unit cost of \$700 per linear foot has also been used to include the cost of junction and inlet structures.

It would likely be necessary to locate the storm drain outside the existing right-of-way due to the presences of sanitary sewer and other utilities. This easement would need to be environmentally cleared along with the freeway.

*Culvert 3 at Station 541+95.* Under ADOT's current plan, a new two barrel 10' x 6' RCBC would be constructed to carry flow for Simpson, Cushing, and TCC Washes. The City is consolidating those flows to a single location north of Clark Street as part of downtown redevelopment. It is proposed here that this flow be carried across I-10 in, for example, a two cell 7' x 10' structure located immediately south of the Clark Street bridge. It would be necessary to move the outlet about 450' southward (and under Clark Street) from its present location to achieve a perpendicular crossing. For structural reasons, the flow-carrying cells would be separated by empty cells to allow for concrete diaphragms needed for lateral stability. Web end flares, which are needed to accommodate post-tensioning cables, would be entirely to the side of the empty cells to avoid affecting hydraulic capacity of the open cells.

Once across I-10, the flow may be carried in a 2 - 10' x 8' RCBC (or other two-barrel culvert of equivalent capacity) the remaining 600' to the Santa Cruz River. Alternatively, the downstream flow can be carried in a new open channel along the proposed extension of Clark Street. Extending the culvert would maximize the redevelopment potential of the property west of I-10 while a channel would provide the opportunity for landscaping to mitigate the loss of trees along the existing channel. It would also be a logical location for a trail connection across the deck park to the Santa Cruz River Linear Park. The cost estimate provided here is based on extending the culvert.

*Culvert 4 at Station 559+50.* The lowered freeway section would also cut through the existing three-barrel 10' x 8' RCBC serving 18th Street Wash. It is proposed that that flow also be carried northward parallel to I-10 about 1,100' in a 4 - 10' x 8' RCBC in existing ADOT right-of-way sufficiently northward to achieve clearance above the freeway. It would then be carried through the deck in four 7' x 10' cells similar to Culvert 3 but in a separate bridge structure.

The parallel culvert carrying the upstream flow could empty into a landscaped ponding area from which it would then enter the bridge cells. The landscaping could include trees in mitigation of trees to be lost along the reach of the existing wash downstream of I-10. The open ponding area would allow easier access for maintenance. The cells of the parallel culvert could also be turned to directly feed into the crossing structure cells which would be hydraulically more efficient and would free up the ponding area for other uses. As with Culvert 4, the flow downstream of I-10 can be carried to the Santa Cruz River in a covered culvert or in an open landscaped channel. The potential for incorporating this structure into the Simpson Street bridge should be explored during the detailed feasibility study. For the cost estimate here, a separate structure has been assumed.

The choices of siphoning and carrying flow through the deck structure will be more fully investigated in the detailed feasibility analysis including preparation of preliminary plans and report to documenting the costs and methodologies for dealing with the various issues.

#### PAVEMENT DRAINAGE

The 2002 study investigated three alternatives -- (1) directly pumping the flow out of the depression as it is collected for which pump stations with sufficient capacity to handle the peak discharge would be needed, (2) extending an outfall storm drain sufficiently downstream that it can be discharged into the Santa Cruz River (which would be north of Grant Road), and (3) storing the flow in a vault under the freeway to be pumped out more slowly by a much smaller pumping system.

The third approach was found to be most cost effective and was recommended at that time. The ability to retain chemical and fuel spills, chemicals used for cleaning, and pavement runoff for removal of sediment and hydrocarbons further support that choice. For this study, the cost estimate is based on that of the 2002 study with several exceptions. This concept will be addressed in more detail in the detailed feasibility analysis.

#### FLOODPLAIN IMPACTS

The 2002 study examined the 100-year floodplain of the Santa Cruz River and determined that flow would not break over into the depressed section of I-10. It was found that breakout flow from Tucson Arroyo would overflow into the depressed section but that relatively simple measures to contain that flow upstream of I-10 can be taken. No further analysis of this has been accomplished under this study, but the issue will be revisited if the deck park proposal moves forward. The impending construction of the Park Avenue Detention Basins will reduce the 100-year peak discharge, favorably affecting this situation.

#### GROUNDWATER IMPACTS

The proximity of the Santa Cruz River and the potential for infiltration and buoyancy was investigated as part of the 2002 study. It was determined that upward hydrostatic pressure on the roadway and lateral hydrostatic pressure on retaining walls can be readily dealt with using granular or geotextile fiber layers and edge drains to direct infiltration to the pavement drainage system. A flow net analysis determined that the maximum rate of infiltration from the Santa Cruz River using very conservative assumptions regarding soil permeability and depth and duration of flow in the river would produce only 6.5 cfs, well within the capacity of the pavement drainage system. A review of water quality monitoring in the area determined that the probability of the infiltrate becoming contaminated to the point of requiring treatment before being discharged is low. Those approaches continue to be valid. Should a depression proposal proceed to detailed design and environmental documentation, borings will be taken to determine both permeability of soil and presence of contaminants.

## SECTION 5. UTILITIES

### WATER

North of Congress, 1,000 feet of 24" water line located within the existing westbound frontage road will need to be relocated or lowered to accommodate the lowered profile. South of Congress, that line is located 10' to 30' feet east of the frontage road and can be left in place.

Along the eastbound frontage road is 600' of 8" water line south of Congress that will need to be relocated further west. There is also 500' of 6" water line located between Clark Street and Mission Lane that will need to be relocated further west. The remainder of that line is 10' to 20' feet west of the frontage road and can remain in place.

The water lines listed in Table 1 cross the lowered portion of I-10 and will need to be lowered. These need to be kept in operation during the construction and will have to be tunneled under the freeway from jacking pits located outside of the frontage roads.

**Table 1. Water Crossings to be Relocated**

Location	Size of Line	Length of Lowered Line
Alameda Street	10"/12"	500'
Congress Street	12"	600'
Clark Street	6"	600'
Clark Street	36" (Reclaimed)	600'
Simpson/Mission	6"	500'
18th Street	6"	500'

### SANITARY SEWER

A 24" sewer line currently located in the westbound frontage road north of Congress is sufficiently deep to remain in place. A 1,600' length of 21" line in the westbound frontage road extending from 500 feet north of Clark to just south of Peak Street will need to be moved eastward outside the frontage road. It will also need to be relocated for 600 feet from 18<sup>th</sup> Street to about 450 feet south of Green Street.

The 30" and 42" sewer located along the eastbound frontage road north of Congress can remain in place. South of Congress, the 30" sewer varies in location next to and within the limits of the eastbound frontage road. Though portions of this line would clear the new retaining walls, it is fragile clay pipe and would likely not survive the construction. All 3,900' of sewer from Congress to 20th Street should be relocated.

There are two sewers crossing I-10 that would conflict with the depressed roadway -- a 42" line in Alameda Street and a 36" line in 18<sup>th</sup> Street. They are not currently active but are maintained to provide backup conveyance for emergencies. Pima County Wastewater Management plans to abandon the 36" line, but the conveyance of the 42" line needs to be retained. Replacing this crossing will involve constructing a parallel 42" line along the east side of the freeway from Alameda Street north to St. Mary's Road where it would turn west and cross the Santa Cruz River in a siphon.

Once across the river, it would reconnect to the existing 42" sewer at Columbia Avenue. The total length of the new line will be 4,500'.

Pima County Wastewater is currently planning a new interceptor line from Alameda Street north to Prince Road. This plan currently includes a 60" sewer line crossing I-10 near Alameda where it would also conflict with the new depressed section. Since this sewer project has not been constructed, no cost has been included for the relocation of this proposed crossing. If this deck park proposal moves forward, it is anticipated that the sewer crossing would be redesigned to occur further north.

#### OTHER UTILITIES

When the frontage roads were constructed, utility corridors were established for underground electric, telephone, gas, and freeway management system facilities. These corridors are 20' to 40' outside the frontage road limits and will not typically be impacted by this construction. Exceptions include above ground facilities such as junction cabinets and transformers which could be impacted by the temporary detours. There may also be localized impacts caused by deck ventilation rooms, access stairwells, and pump rooms.

In such cases, the utility corridor would be rerouted around the conflict for a distance of 100' to 200'. The cost to this project would consist of new conduits, trenching and backfill. The responsibility of pulling the new conductors would fall on the private utility companies. The utilities in the corridors include TEP conduits, Qwest Communication conduits, Southwest Gas lines, and Freeway Management System (FMS) conduits owned by ADOT.

**Table 2. Impacted Private Utility Crossings**

Location	Size and Type of Line	Owner
Congress Street	2 - telephone	Qwest
Simpson/Mission	48" Steel Casing electrical substation feed	TEP
Simpson/Mission	Fiber optic telephone in 5" steel casing	GST Tucson
19 <sup>th</sup> Street	8" natural gas	SW Gas

Utilities crossing I-10 that will be impacted by the proposed lowering are indicated in Table 2. While the cost of relocating these utilities will be significant, it would not be borne by this project and has not been included in the project cost estimate.

## SECTION 6. ENVIRONMENTAL CLEARANCE

Because this project would modify a federal facility; environmental documentation complying with the National Environmental Policy Act of 1969 (NEPA) and the policies of the Federal Highway Administration (FHWA) as the lead federal agency must be completed. The environmental documentation process provides steps and procedures for evaluating potential social, economic, and environmental impacts of a proposed action. It also allows the opportunity for public and local, state, or other agencies to provide input and comment. In addition, the environmental documentation provides FHWA, ADOT, and the City of Tucson a detailed analysis to better examine and consider the level of impacts on sensitive social, economic, and environmental resources, and assists in the decision-making process. This section discusses the requirements with which this project must comply as well as the anticipated impacts of the project based on the conceptual engineering to date. These requirements and impacts have been investigated to determine the appropriate level of environmental documentation, and to estimate the cost and time associated with the environmental investigations.

To determine the existing social, economic and environmental conditions within the study area, existing information has been assembled and reviewed. Interviews have been conducted with local, state, and federal agencies, and limited field reviews of the area have been conducted.

I-10 was constructed through the City of Tucson in the early 1960s prior to the promulgation of NEPA and; therefore, without substantial environmental analyses. As a result, there is limited information available about the social, environmental and economic conditions of the corridor prior to the original construction. Because I-10 in this area was constructed on fill; environmental conditions at and below ground surface would be expected to remain largely as they were at the time of construction.

The environmental issues expected to be encountered are explained in this section. Conclusions are provided for each indicating if the particular issue could rise to the level of "significant" impact, therefore triggering an environmental impact statement. The primary concern, however, is to determine if there exist any "fatal flaw" issues of sufficient severity to prevent the deck park proposal from going forward. None have been identified.

### SUBSURFACE HAZARDOUS MATERIALS

It is important to locate sites of potential soil and groundwater before performing construction activities. According to ADOT, the existing profile of the frontage roads has been investigated extensively, but no investigations occurred prior to the construction of I-10 and the frontage roads.

Hazardous material investigations for the frontage road construction revealed typical urban establishments that used or stored hazardous materials, such as gasoline stations and cleaners. Industrial land uses including landfills, tanneries, and railroad operations were noted also in the

general area. Although none of these land uses are known to occur below the fill for I-10, a former railroad (El Paso Southwestern Railroad) and a highway were located in the project area previously.

During the geotechnical investigations performed by NCS Consultants in 2005 for the design of *I-10, Congress Street to 29th Street*, minimal soil impacts were found. Odors were noted in two borings taken near Clark Street at depths of approximately 16' to 22' below the I-10 mainline, probably just below the natural ground on which the existing fill was placed.

Environmental investigations within the project area could be performed through preconstruction subsurface investigations (borings) in the proposed project area, through environmental oversight during excavation, or a combination of these techniques. Preconstruction borings are preferable because they allow early detection and remediation. In this case, the construction of I-10 on fill and the need to maintain traffic during construction may require the use of directional borings.

This project would probably use a combination of methods for the discovery and mitigation of hazardous materials. Because of the need to excavate, the environmental investigations would probably occur concurrently.

Approximately two thousand feet of concrete-asbestos water lines would be relocated for the proposed project. The contractor would be required to handle, transport, and dispose of the material in accordance with approved asbestos handling procedures.

Perched groundwater varying from 30 to 65 feet below ground surface is known to occur in the area. Previous groundwater sampling shows no impact to perched groundwater.

These issues identified here regarding hazardous materials are not uncommon to projects in urban areas and are not expected to constitute a significant impact.

#### CULTURAL RESOURCES

Resources of historic significance exist within the project area and undiscovered resources of historic significance may exist as well. Section 106 of the National Historic Preservation Act (NHPA) states that federal agencies must take into account the effects of their undertakings on historic properties and accommodate preservation and development through consultation among affected and concerned parties. 36 CFR 800 is the regulation developed by the Advisory Council on Historic Preservation to implement Section 106 of the Act.

Desert Archaeology and ADOT have provided information on documented archaeological sites and historic districts within the I-10 corridor. Although none of these sites are located within the proposed project area, the density and significance of these sites in the surrounding area suggests a likelihood of encountering subsurface features that would be eligible for the National Register of Historic Places (NRHP). Previous experience suggests that it would be unlikely that surface evidence of these features would exist.

In addition to archaeological sites, several historic districts occur within the proposed project vicinity. These include Papagoville, Barrio Kroeger, Barrio El Membrillo, El Presidio, Barrio Anita, and Barrio Viejo. Although the buildings within the proposed project area are outside the boundaries of the designated historic districts, buildings of potential historic age (over 50 years) exist within the proposed project area.

A new programmatic agreement (PA) for I-10 would be required. The PA between FHWA, SHPO, ADOT and the Advisory Council on Historic Preservation that exists for I-10 differs in scope from that of the deck park proposal. The new PA would establish initial consultation with agencies and tribes, develop agreement on the Area of Potential Effect of the proposed project, establish the scope of the cultural investigations, and determine whether or not Traditional Cultural Properties would be involved. In addition, the PA would outline how discoveries of certain types (e.g. habitations, human remains, etc.) would be addressed as the project progressed to minimize project delays.

Additional cultural investigations would be needed, perhaps extending outside the construction footprint. No cultural investigations were completed prior to the original construction of I-10. The investigations needed for this project will require that the existing freeway surfacing and embankment be removed prior to cultural excavation and investigation. These investigations would be conducted in conjunction with the hazardous material investigations discussed earlier, and would be considered in construction phasing.

Historic building inventory forms would be completed for any historically significant structures that are impacted by the project. The inventory forms will document the relevant features of the buildings to exhaust their data recovery value.

The cultural resource process would extend the length of construction and is likely to uncover resources of historic importance. These will be addressed by developing and implementing the PA. Cultural resource impacts are not, however, expected to present a significant impact.

#### SECTION 4(f)

Section 4(f) of the U.S. Department of Transportation Act of 1966 states that the FHWA “may approve a transportation program or project requiring publicly-owned land of a public park, recreation area, or wildlife and waterfowl refuge of national, state, or local significance, or land of a historic site of national, state, or local significance (as determined by the federal, state, or local officials having jurisdiction over the park, area, refuge, or site) only if there is no prudent or feasible alternative to using that land and the program or project includes all possible planning to minimize harm to the park, recreation area, wildlife and waterfowl refuge, or historic site resulting from the use” (49 USC 303). It is important to note that new FHWA rules on 4(f) do not require that *de minimis* (minor) takes consider avoidance alternatives.

A use of a Section 4(f) resource as defined in 23 CFR 771 occurs when land is permanently incorporated into a transportation facility; when there is a temporary occupancy of land that is adverse, and/or when there is a constructive use of land. A constructive use of a Section 4(f) resource occurs when the project’s proximity impacts are so severe that the protected activities, features, or attributes that qualify a resource for protection under Section 4(f) are substantially impaired.

Several existing or potential 4(f) resources exist within or near the proposed project area. These include existing park and recreational facilities (the Santa Cruz River Park) or planned park and recreational facilities (the El Paso Southwestern Railroad greenway). They also include resources that have been placed on the NRHP or determined eligible for the NRHP. Subsurface features may be encountered beneath I-10 which are eligible for the NRHP under Criterion D. Criterion D resources are those that have yielded or may likely yield information important in prehistory or history. Resources eligible under Criterion D, however, are not protected under Section 4(f).

A Section 4(f) evaluation will probably be required. By following the PA established for cultural resource investigations, and by including specifically-targeted mitigation measures, significant impact will likely be avoided.

#### TITLE VI/ENVIRONMENTAL JUSTICE

Title VI of the Civil Rights Act of 1964 and related statutes assure that individuals are not discriminated against under any federal program or activity on the basis of race, color, national origin, age, sex, and disability. EO 12898 *Federal Actions to Address Environmental Justice to Minority Populations and Low Income Populations* requires federal agencies to consider impacts to minority and low income populations as part of environmental analyses to ensure that these populations do not receive a disproportionately high number of adverse human health impacts as a result of a federal project.

Although the proposed project would be expected to improve community cohesion, disproportionate effects on minority and low income populations within the study area must be examined and

documented. There may be temporary impacts to residents' access and detours through low income areas would also need discussion.

With the existing elevated freeway, the City is challenged to provide a sense of unity within the downtown area. This project would remove a significant physical and psychological barrier. It would also improve the connection between the east and west sides of I-10, substantially enhancing the sense of unity that the City seeks to promote. Although there are issues to be considered, these can be dealt with and are not expected to constitute a significant impact

#### ECONOMIC IMPACT

The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended, requires a "fair and equitable treatment of persons displaced as a result of federal and federally assisted projects in order that such persons shall not suffer disproportionate injuries as a result of programs deigned for the benefit of the public as a whole". Sections 28-1841 through 28-1853 of Arizona Revised Statutes provide for implementation of the Federal Relocation Assistance Program in Arizona.

According to FHWA Technical Advisory T 6640.8A, economic impacts may result if the proposed project: (1) produces changes in travel patterns and accessibility; (2) causes economic effects on the regional and/or local economy (e.g. tax revenues); (3) affects the economic viability of existing highway-related businesses; or (4) disrupts or substantially changes existing economic patterns.

The west side of the proposed project area is characterized primarily by highway dependent commercial land uses, although vacant properties, residential land uses, and a Tucson Electric Power Substation are also present. Lowering the frontage roads through this section will limit visibility and access and may initiate an EIS process.

The east side of the proposed project area is largely vacant with some residences and small commercial facilities present. The City of Tucson's comprehensive Downtown revitalization plan, covers a large portion of the proposed project area.

Any acquisition or relocation found necessary would conform to the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 as amended, and Sections 28-1841 through 28-1853 of Arizona Revised Statutes.

The wider economic impact to the community must include long-term impacts as well as temporary impacts during the construction period.

#### NEIGHBORHOODS AND SOCIAL SERVICES

According to FHWA Technical Advisory T 6640.8A, transportation projects must consider the changes they would cause to neighborhood or community cohesion for various social groups. These changes may include splitting neighborhoods, isolating a portion of a neighborhood or an ethnic group,

generating new development, changing property values, or separating residents from community facilities.

Although the project area has long been divided by roadways and railroad facilities, the construction of an elevated I-10 in the early 1960s created a major obstacle to free movement between the east and west sides. One example of this division is that children from the neighborhoods west of I-10 attend schools east of I-10. These schools include Drachman Elementary at 1085 S. 10<sup>th</sup> Avenue (grades Kindergarten to 3), Carrillo Intermediate Magnet School at 440 S. Main Avenue (grades 3-5), Safford Middle School at 200 E. 13<sup>th</sup> Street (grades 6-8), and Tucson High School at 400 N. 2<sup>nd</sup> Avenue. To accommodate children walking to area elementary schools, an underpass was constructed beneath I-10 near 18th Street, which requires school crossings and crossing guards at both the eastbound and westbound I-10 frontage roads in this area.

During construction of this project, students would be bussed around the construction zone as was done during the frontage road construction. A new bridge with pedestrian facilities crossing I-10 at Simpson Street would provide access to these schools once construction is complete, providing pedestrians with access that is essentially equivalent to current conditions. It is important to note that these same modifications to school access are also proposed under the I-10 widening plan.

Neighborhood connectivity would be improved and access to social services would be equivalent with the proposed project.

#### WATER QUALITY

Water quality is governed by a number of Federal and State laws and regulations. Applicable regulatory requirements are as follows:

*Sections 404, 402, and 401 of the Clean Water Act (CWA)* – require a permit for the placement of dredged or fill material into "waters of the United States", require a permit from ADEQ/USEPA for construction activities when one acre or more of land would undergo excavation and/or grading (AZPDES - NPDES), and require projects within certain waters to obtain water quality certification from ADEQ, respectively.

*Section 1424(e) of the Safe Drinking Water Act* - under a Memorandum of Understanding between EPA and FHWA dated October 1984, projects within sole source aquifers are subject to review by EPA.

*1980 Arizona Groundwater Management Code* – regulates withdrawals of groundwater for non-irrigation uses (i.e. dewatering) within the Tucson Active Management Area through permits from the Arizona Department of Water Resources (ADWR).

*Arizona Revised Statutes 49-241 through 49-252, and Arizona Administrative Code R18-9-101 through R18-9-403* – require that facilities that discharge pollutants either directly to an aquifer, to the land surface, or the vadose zone (the area between an aquifer and the land surface) such as

impoundments or point source discharges to navigable waters, obtain Aquifer Protection Permits from the ADEQ.

Several jurisdictional waters of the U.S. exist in the proposed project area (Arroyo Chico, 18th Street Wash, Simpson Wash, smaller unnamed washes, and the Santa Cruz River) and all of these waters would be affected to some degree by the proposed project. Proposed project construction activities would be subject to erosion from stormwater runoff.

The proposed project would reroute flows along the 18th Street Wash from its current I-10 crossing location to a new crossing location to the north. The approximate area of loss of the existing 18th Street Wash would be 1.9 acres, requiring an individual Clean Water Act Section 404 permit. The use of an inverted siphon would minimize this impact and may qualify under a nation-wide permit, though the rerouting of smaller feeder washes may trigger an individual permit in any case.

Assuming information contained in the preconstruction notification is complete, nationwide permits are typically issued within a 90-day period. Individual Section 404 permit for projects of this nature usually require 12 months. Normally, the individual Section 404 permit application follows completion of the environmental documentation. Environmental documentation is completed using preliminary design with the engineering detail usually not sufficient for an individual 404 permit application. In the case of the proposed project, however, the detailed drainage design will be developed earlier than normal and it is anticipated that the 404 permit application would proceed concurrently with approval of the environmental documentation and development of the construction plans. It is also anticipated that the environmental documentation produced for the proposed project would fulfill the Corps' requirement for an environmental assessment under Section 404 b(1). Should this be the case, the individual 404 permit would not impact the overall project schedule.

Detention facilities for the treatment of stormwater runoff from the proposed project will be examined as potential mitigation for the loss of vegetation along 18th Street Wash. Under Section 401, the proposed project would require also water quality certification from ADEQ (normally performed concurrently with the 404 permit application). Close coordination with the U.S. Army Corps of Engineers will be required throughout project design.

Because the project would disturb more than an acre of topsoil, it would be required to comply with the NPDES/AZPDES program. Prior to construction, ADOT and the contractor will submit a Notice of Intent to ADEQ. To comply with Section 402, a Storm Water Pollution Prevention Plan (SWPPP) will be prepared for the proposed project. The SWPPP will incorporate temporary erosion control measures during construction, permanent erosion control measures when the project is completed, and good housekeeping practices for the control and prevention of release of water pollutants.

ADOT is one of eight public entities required to obtain a stormwater permit as part of the Phase I Stormwater Rules (1990). Because this project is within a designated Municipal Separate Storm

Sewer System (MS4), it will be subject to the Phase II minimum control measures which went into effect on March 1, 2003. Post-construction stormwater management requirements would govern collection, storage, treatment, and discharge of stormwater to minimize impacts to water quality.

It will also be necessary to coordinate with EPA regarding protection of the Upper Santa Cruz and Avra Valley Basin sole source aquifer, and with the Pima County Flood Control District to ensure compliance with Executive Order 11988, *Protection of Floodplains*, and Title 23 of the Code of Federal Regulations (CFR), Part 650 (23 CFR 650). Both of these relate to location and hydraulic design of highway encroachments on floodplains.

Extensive coordination with regulatory authorities (Corps, ADEQ, ADWR, EPA, and others) will be required to successfully address the proposed project's water quality issues and receive the required permits.

#### BIOLOGICAL RESOURCES

Natural resources are governed by a number of Federal and State laws and regulations. These regulatory requirements include the following:

*Endangered Species Act of 1973, as amended* – requires protection of wildlife species which are federally listed as endangered, threatened, proposed, or candidate.

*Arizona Native Plant Law (ANPL)* – requires notification of the Arizona Department of Agriculture prior to construction to afford commercial salvagers the opportunity to remove and salvage protected native plants.

*City of Tucson Native Plant Preservation Ordinance (NPPO)* – requires the development of a Native Plant Protection Plan (NPPP) to protect listed native plants.

*Executive Order 13112* – requires programs to address invasive species.

The proposed project is within the historic range of the Cactus Ferruginous Pygmy-Owl (CFPO), a federally listed endangered species. Native plants protected by the ANPL and the City of Tucson's NPPO are present within the project area and would be impacted by construction of the proposed project. In addition, prior surveys have identified the presence of invasive species within the project area.

A Biological Review (BR) was completed for the area as a part of the Environmental Reevaluation in conjunction with the current design of *I-10 Congress Street to 29<sup>th</sup> Street*. The BR stated that the western portion of the project area is located within CFPO Zone 2 and the eastern portion of the project area is located within the Tucson CFPO Urban Exclusion Area. A Corps Biological Evaluation was also completed for that project and, based on the February 2003 agreement between the Corps and the USFWS, a conclusion of "may affect, not likely to adversely affect" was recommended for the CFPO. The Corps was obtaining concurrence from USFWS for the Section 404 permit.

Prior to construction, a native plant survey would be conducted to determine the types of species and number of individual plants that would be impacted. Based upon this investigation, a Native Plant Protection Plan (NPPP) would be developed to identify impacts to native vegetation and develop mitigation measures. It is possible also that this vegetation loss could be considered an additional affect to the CFPO.

Invasive species within the project area would be treated prior to construction and any necessary treatments would continue following construction. Disturbed soils would be landscaped or seeded using species native to the project vicinity and contractors would be required to take precautions to prevent the reintroduction of these species.

#### AIR QUALITY

The 1990 Clean Air Act Amendments require transportation projects to conform to (be consistent with) air quality implementation plans. To be a conforming project, it must be part of an approved fiscally constrained transportation plan and transportation improvement program. The approved plan and program are subject to an air quality conformity demonstration performed by the Pima Association of Governments (PAG). The I-10 widening project is part of the approved *2025 Regional Transportation Plan* (RTP) and *2005-2009 Transportation Improvement Program* (TIP), and therefore is considered to be in regional conformity. The proposed I-10 Deck Park project would provide the same capacity as the currently planned improvements, although the deck park proposal may influence travel patterns within the Tucson downtown area.

The funding sources for the proposed Deck Park project within the existing RTP and TIP and would need to be updated to include the deck park proposal. A new air quality conformity demonstration may be required as a part of those changes.

#### TRAFFIC NOISE

ADOT's Noise Abatement Policy (NAP) (March 21, 2000) defined a traffic noise impact as (1) when the predicted level approaches or exceeds the FHWA's Noise Abatement Criteria (NAC). ADOT defines "approach" as being within 3 dBA of the appropriate NAC. Under this policy, residential impacts would occur when the future Leq(h) value is 64 dBA or greater; or, (2) when the predicted level substantially increases over existing noise levels. "Substantial" is defined as an increase of 15 dBA or higher.

According to the Environmental Reevaluation for I-10 (St. Mary's Road to 29th Street), dated September 2005, traffic noise modeling predicted that noise levels at 20 of 23 noise sensitive receivers within the project area would exceed the federal NAC and noise abatement was evaluated for these locations. Noise abatement was not considered at the commercial locations but was considered for residences closest to I-10. These walls were determined to exceed the NAP's cost per benefited receiver criterion; and were not included in the plans. Rubberized asphaltic concrete was planned for use on the I-10 mainline to reduce tire/pavement noise.

ADOT's Noise Abatement Policy (November 29, 2005) has been amended since the re-evaluation. The definition of traffic noise impact was not affected, but the cost per benefited receiver criterion has changed. New traffic noise modeling will be required as part of the proposed project. Because the deck park proposal would lower the mainline and frontage roads as much as 30 feet below the surrounding terrain, noise levels in this area would be reduced substantially. The planned use of rubberized asphaltic concrete would reduce tire/pavement noise even further.

#### VISUAL QUALITY

Visual impact is considered from two perspectives -- the view of motorists from the roadway; and the view of the roadway to the surrounding community. Visual resources and effects of construction on these resources are defined by identifying key views and considering community goals and preferences.

Current highway users pass through the Tucson downtown area on an elevated roadway. Foreground views consist of structures and businesses adjacent to the interstate, middle ground views include the Tucson downtown skyline, and background views (depending upon direction) include the Tucson, Santa Catalina, and Rincon Mountains. The elevated roadway allows motorists to see the quality middle and background views as they pass through Tucson. With the lowered roadway, the middle and background views would be limited though the opportunity for improvement to foreground views will exist though use of art, color treatments, and landscaping.

Views of the roadway from the surrounding community are not of high quality at the present time. Incorporation of landscape and art in the current plan would redress this issue. Lowering the roadway will dramatically alter and improve this situation, and is a key reason the deck park proposal is being considered.

The views available to the surrounding community would also improve dramatically. The lowered section of interstate would open the area to foreground views of a proposed park-like setting over the roadway, the Tucson downtown skyline would appear in the middle views, and background views of the surrounding mountain ranges would occur.

#### PUBLIC INVOLVEMENT

NEPA has three primary requirements: (1) to determine and disclose the environmental impacts of proposed projects; (2) to involve affected federal agencies in the investigations and decision making process; and (3) to involve the public in the project design and evaluation process. A proactive public involvement program will be needed if the deck park proposal moves forward. A public involvement plan should be prepared early in the project to ensure that the public contributes to the study and has full access to study results. The public involvement plan should include numerous federal, state, and local agencies, utility companies, and residents and business owners.

FHWA must ensure that public concerns are addressed adequately before they issue a Record of Decision.

#### LOGICAL TERMINI

Federal actions are required to “connect logical termini and be of sufficient length to address environmental matters on a broad scope.” It is important that all participants agree early to the proposed project’s logical termini.

#### SCHEDULE

The environmental process will occur concurrently with design and other activities and will not affect the start of construction regardless of whether an EA or EIS is required.

## SECTION 7. CONSTRUCTION SEQUENCING AND TRAFFIC CONTROL

A preliminary three-phase approach has been developed for construction sequencing and traffic control. It has been used to ensure that construction is possible, determine the approximate cost, estimate the time required for construction, and to evaluate the impact to immediately adjacent parcels and the surrounding area. This plan is shown schematically in Figure 7 on following page. This section discusses issues that will be encountered with the construction and that need to be considered in developing the construction sequencing and traffic control plans. It then describes the approach proposed here in more detail.

### KEY FACTORS

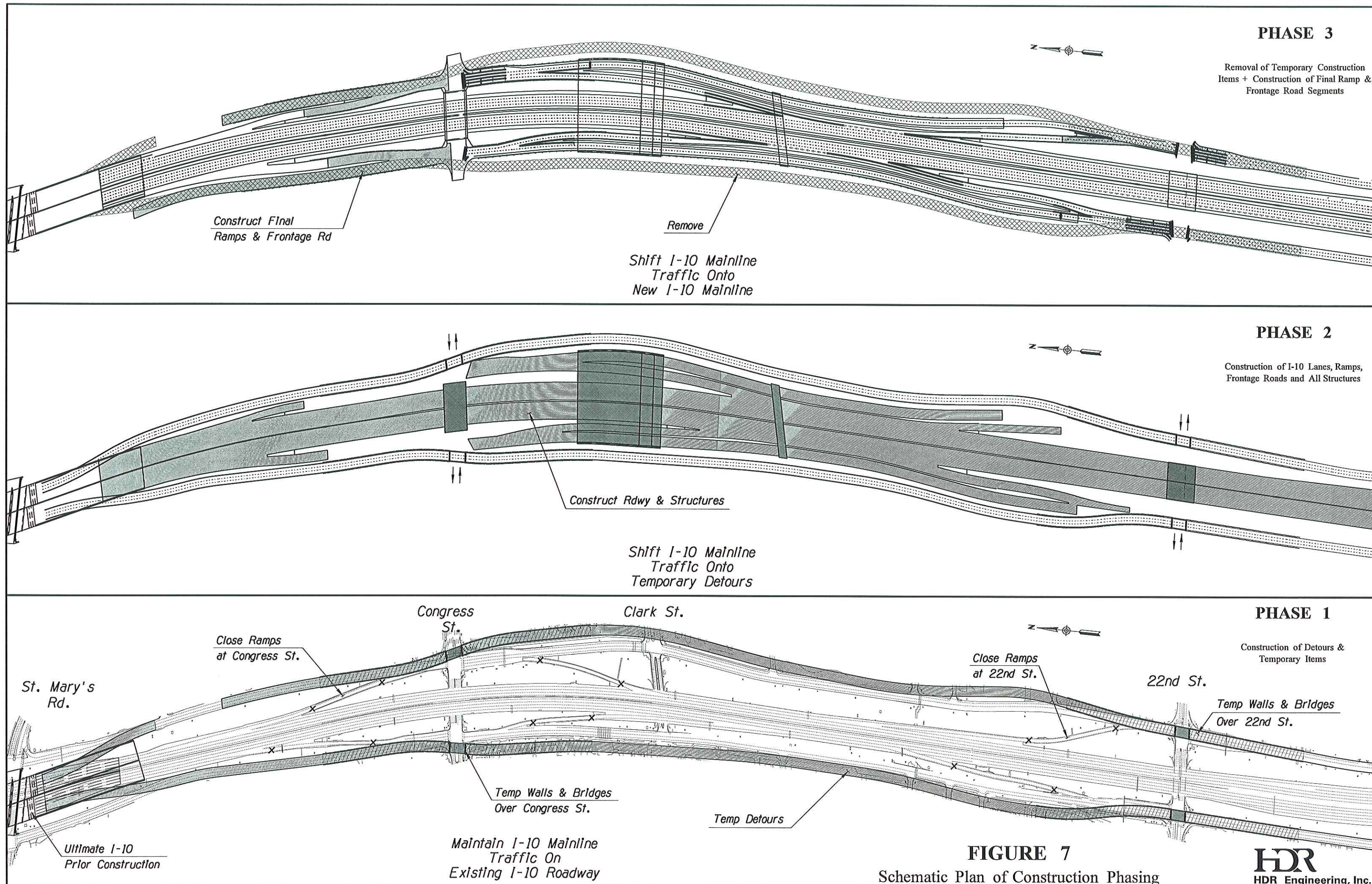
Two factors figure significantly into the constructability of this particular deck park proposal. The first is the magnitude of elevation difference that must be accounted for between the existing mainline profile and that of the lowered section. From Congress Street south, that would be on the order of 50'. When construction of drainage facilities is considered, that amount becomes 60'. Under the current plan, the profile of the new elevated freeway would increase no more than five or six feet. That elevation differential precludes the ability to detour traffic within the construction footprint as under the current plan.

The second issue under this particular proposal is that the existing frontage roads will no longer be available for use as detours since they will be depressed along with the mainline. These issues together have implications on the cost and duration of construction.

### GENERAL APPROACH

The general approach proposed involves detouring three lanes of mainline traffic to each side of the construction zone in temporary construction easements outside the existing right-of-way. Temporary bridges for the detours over Congress Street and 22nd Street would allow those arterials to remain open to cross traffic generally throughout the construction though access to I-10 at those locations would not be possible.

This has the benefit of allowing the bulk of the construction including environmental clearance, roadway excavation, the depressed sections of mainline and frontage roads, the deck park structure, and the cross-street bridges to occur at one time. Once construction is complete, those easements would terminate.



**FIGURE 7**  
Schematic Plan of Construction Phasing

## ISSUES AFFECTING CONSTRUCTION SEQUENCING AND TRAFFIC CONTROL

Several concerns and factors influencing the construction and detouring approach are discussed here.

*4(f) Concerns.* Detours have been kept inside the existing right-of-way on both sides of I-10 north of Congress Street to avoid potential 4(f) impacts. On the west side are the Santa Cruz River Linear Park and the Sentinel Plaza. The frontage road construction included a retaining wall to avoid impacting those facilities. Even temporary use of that land poses 4(f) issues that will be avoided if possible.

*Access Concerns.* Much of the properties east of I-10 between Congress Street and 22nd Street is owned either by the City of Tucson or the State of Arizona, and presents no concern with access during construction. Depressing the freeway and frontage roads will alter access to some properties west of I-10 currently being served by the eastbound frontage road.

*Detour Capacity.* Under the current plan, the mainline will be reconstructed as one project from Prince Road to 22nd Street. Five lanes of detoured traffic would be maintained in each direction -- two for through mainline traffic and three for local traffic traveling along the 5.1 miles of local frontage roads.

Under this particular deck park proposal, the project limits would be reduced to the 2.0 miles between St. Mary's Road and 29th Street. Three lanes of through mainline traffic would be maintained in each direction along this shorter reach. Local traffic would be supported along the surrounding existing roadway network.

*Deck and Bridge Construction.* The girders needed to span the mainline and frontage roads are too long to transport over city streets and would need to be cast on site. The most suitable approach from the perspectives of cost, timing, and aesthetics would be to cast these structures in place on soffit fill. The construction sequencing approach proposed here allows that to occur.

## CONSTRUCTION PHASES

The proposed phases of construction and the detouring of traffic for each particular phase is explained here.

*Phase 1. Construct Detours.* The detours for mainline traffic would be first constructed including temporary bridges over Congress and 22nd Streets. The existing frontage roads would be closed to traffic. The frontage roads north of Congress would be removed and the detour connections to the mainline built. The exact location of these connections will depend on the design of the transition from the by-then-constructed portion of I-10 from Prince to St. Mary's Road. The approaches for the temporary overpasses at Congress and 22nd would be constructed using temporary mechanically stabilized earth (MSE) walls. Temporary widening of ramps within the I-10/I-19 System Interchange would also be accomplished in this phase. This phase is estimated to take 12

months during which mainline freeway traffic would be unaffected but frontage road traffic and access between I-10 and Congress Street and 22nd would be eliminated.

*Phase 2. Main Construction.* The bulk of the construction would occur in this phase. Mainline traffic would be shifted onto the detours. The existing freeway pavement, embankment, and bridges would be removed. Short-term closures of Congress and 22nd Street would be needed to remove the structures at those locations. With the existing roadway and embankment gone, environmental investigations would begin. The areas where the crossing structures are to be located would be cleared first to allow work on those structures to begin as early as possible. Other work to be completed during this phase includes excavating for the lowered mainline and frontage roads, constructing retaining walls, constructing the drainage systems, grading and paving the mainline, ramps, and frontage roads, installing traffic control devices, and so forth.

As this discussion indicates, most of the construction will occur during this phase. The time estimated to complete this phase is 40 months. The impacts on local traffic and circulation are discussed separately in Section 8.

*Phase 3. Complete Frontage Roads, Remove Detours.* The detoured traffic will be shifted to the newly constructed mainline, and the temporary detours removed. Portions of the new frontage roads that could not be constructed while the temporary detours were in place will then be completed and opened to traffic. Clean-up and other finalization work will be performed, ending the project. This phase will require 14 months.

#### Construction Schedule

The total time required for construction is estimated to be five years and nine months. The detailed schedule on which this information is based on is provided in Appendix A. A summary of the primary construction phases is as follows:

Phase	Work to be Completed	Traffic Impact	Duration
1	Construct Detours	No impact to mainline traffic except ramps at Congress Street and 22nd Street are closed. Frontage roads closed.	12 months
2	Construct mainline and most of frontage roads and ramps	Mainline traffic on detours. See Section 8 for discussion of local circulation and access.	40 months
3	Remove detours. Complete frontage roads and ramps	Mainline open to interstate traffic. Frontage roads and ramps opened as they are completed.	14 months

## SECTION 8. OTHER COVERED ROADWAY ISSUES

### TRANSPORT OF HAZARDOUS MATERIALS

To address hazardous material routing and hazardous material incident response, inquiries have been made to the agencies listed Table 3. A review of hazardous and radioactive material routing guidelines and of the United States Code pertaining to hazardous materials has also been made. The following understanding of the transportation of these materials has been attained.

According to the US Code (49 USC 51 §5112), the U.S. Department of Transportation delegates to the states the responsibility of developing, implementing, and maintaining the list of designated and restricted routes. In Arizona, ADOT is responsible for the route designations and the Department of Public Safety is responsible for the enforcement of placarded materials along these routes. Local governments are responsible for developing, implementing, and maintaining the list of designated and restricted routes within their respective jurisdictions. A local government may request that ADOT restrict hazardous material transport through a particular area. It is then ADOT's responsibility to analyze and adopt or reject that request based upon a number of considerations including, but not necessarily limited to, public safety and the presence of acceptable alternative routes.

Carriers of hazardous and radioactive cargo are responsible for planning their transportation routes. To do so, carriers use lists of designated and restricted routes by the state as published in the Federal Register. The latest list of restricted routes in Arizona was published in the Federal Register, Volume 65, No. 233, Monday, December 4, 2000. In Arizona, only three routes are restricted for all hazardous materials including radioactive materials.

Other than compliance with the National Fire Protection Association (NFPA) Code for tunnel construction and fire protection, there are no regulations or design criteria in place addressing safety issues in tunnel situations. The proposed project will comply with the NFPA code. Emergency responders would amend the local emergency response plan to address the covered freeway.

Unless a local agency requests that ADOT change the statewide hazardous routing designation through the deck park area, or unless ADOT makes that decision on its own, current practices regarding transport of hazardous materials through Tucson on I-10 would continue. If hazardous

**Table 3. Entities Contacted Regarding Transport of Hazardous Materials**

Arizona Department of Public Safety
Arizona Department of Transportation
Arizona Emergency Response Commission
Federal Highway Administration
Federal Motor Carrier Safety Administration
National Response Center
National Transportation Safety Board
Pima County Department of Homeland Security
Transportation Security Administration
Tucson Fire Department
Tucson Police Department
U.S. Department of Homeland Security

materials are restricted, an alternative route could conceivably be that currently used for oversized loads utilizing SR 86 and SR 85 north to Gila Bend.

#### ILLUMINATION AND SPECIAL SIGNING

Lighting within the covered freeway portion will likely be needed. Standard design and construction approaches will be applied. Variable message signing warning of incidents requiring motorists to exit the freeway or exercise special care will be provided as part of the freeway management system (FMS) as discussed in the following section.

#### VENTILATION AND FIRE SUPPRESSION

The need for artificial ventilation in the covered section of freeway will be evaluated during the detailed feasibility analysis. It is anticipated that fire protection including standpipes, emergency access, and a fire suppression system will be needed as well. The fire suppression system would probably involve a chemical fire suppressant rather than water which can spread rather than extinguish gasoline fires.

#### DECK PARK OPERATION AND MAINTENANCE

Periodic maintenance of the deck park will include testing and repair of the lighting, ventilation, and fire suppression systems. Cleaning the walls and ceiling within the covered section will be periodically required. Cleaning will likely consist of power washing. Cost for power to operate the ventilation, lighting, and pumping systems will also be incurred.

## SECTION 9. TRAFFIC CIRCULATION

There have been a number of studies addressing traffic capacity and circulation along I-10 and in the downtown area. The information presented here is based on review of the previous work and discussions with City of Tucson and ADOT staff.

The documents reviewed are the following:

*I-10, St. Mary's to 29<sup>th</sup> Street Traffic Report*— That study included evaluation of traffic operations associated with widening of I-10 to 4 lanes from St. Mary's to 29th Street.

*I-10, Prince Road to 29th Street* — That study reviewed the traffic circulation issues related to the construction traffic control sequence for the planned I-10 widening from Prince Road to 29th Street.

*Downtown Traffic Study for Conversion of One-Way Streets to Two-Way Operations (2003)* - That report reviews the implications of changing major downtown arterials from one-way to two-way operation. The arterials assumed to be converted are Broadway Boulevard, Congress Street, 6th Avenue, Stone Avenue, Alameda Street and Pennington Street. The circulation scenarios were reviewed for existing conditions (2002), interim (2010), and ultimate conditions (2025).

*Congress Street Master Plan (2005)* – This document, which was a follow up to the two-way conversion study, investigated keeping Broadway Boulevard and Congress Street as one way streets with two lanes in each direction. It was assumed that the rest of the two-way traffic circulation changes would be made. It also reviewed circulation scenarios for existing conditions (2002), interim (2010), and ultimate conditions (2025).

*Major Transit Investment Study Tier 2 Traffic Analysis*- That study reviewed the traffic operation implications of street car operations downtown and along Campbell Avenue and Sixth Street.

The findings of these studies provide insight into the issues associated with construction under the deck park proposal.

Traffic circulation issues associated with this deck park construction fall into two categories -- (1) the impact of construction on capacity and operation of freeway traffic as it is detoured through the construction area, and (2) the traffic circulation and access changes that the deck park construction will affect in downtown and nearby areas.

### FREEWAY OPERATIONS

As discussed in Section 7, this deck park proposal limits detoured I-10 traffic to three lanes each direction during much of the construction period. Improvements at the 29th Street and at Speedway interchanges are recommended to improve traffic flow during construction. The nature and extent of such improvements, and the degree of relief they would provide, has not been determined here.

## LOCAL CIRCULATION

Access across I-10 during construction is an important local issue. As described in Section 7, detour overpasses will be provided at Congress Street and at 22nd Street in response to this need. Access between the mainline detours and cross streets will be limited during construction at those locations.

*Access to Adjacent Parcels.* As also described in Section 7, for this particular proposal the frontage roads will be closed during certain periods of construction. While physical access from the detours is possible, it may be challenging due to operational and capacity issues. Quantitative analysis including traffic modeling would be necessary to make that determination. Widening the detours may offer the best approach for providing access during construction.

*Access Between the Freeway System and Downtown Area.* For this particular proposal, travelers destined to or departing from downtown to the south and east on I-19 and I-10 will be directed to use the 22nd Street/29th Street TI. It would be necessary to travel surface streets miles along 29th or 22nd Streets and 10th or 6th Avenues. Those wishing to connect to west of I-10 would use the 22nd Street/29th Street TI and 22nd Street to Mission Road. Traffic bound for I-10 along Congress and Broadway would be diverted to parallel routes like 22nd Street, 6th Street, and Speedway Boulevard.

Downtown access along I-10 from the north would be by the Speedway Boulevard TI via Stone, Main and Granada Avenues. This would require approximately two miles of travel over surface streets. Those traveling to or from destinations west of I-10 could use Speedway Boulevard or St. Mary's Road. Traffic volume will increase on surrounding streets during the construction of this proposed particular proposal. Results from the two-way traffic conversion study and other past studies indicate that there will be increases in peak hour congestion throughout the local street network. The increased volume of traffic, particularly trucks, will also impact the area through which it passes. Measures for mitigating this impact should be sought.

## POST CONSTRUCTION CONDITIONS

With construction complete, the I-10 mainline will consist of four through lanes in each direction plus auxiliary lanes between consecutive on- and off-ramps. Frontage roads will have two lanes each direction in a lowered configurations. This configuration was discussed in Section 2 and depicted in the typical roadway sections of Figure 2. The effects of the ultimate configuration on traffic operation are as follows.

*Freeway Operation.* As stated in Section 2, it is anticipated that I-10 will operate generally as it would under the current plan. The lane configurations, turning lanes, and geometrics of other operational features have been retained for that purpose.

*Incident Management.* In some emergencies it may be necessary to divert traffic from I-10. It is not, however, clear if the incident management practices in place would be significantly different with the elevated configuration. In any event, alternate routes would be identified depending on the location

and nature of the incident, and communicated to traffic via the freeway management system (FMS). The FMS would include variable message signs well enough in advance of the covered section to notify traffic to exit the interstate and of potential alternate routes. This system and the need for special monitoring within the covered section can be managed through the Interim Traffic Operations Center currently planned.

*Local Circulation.* Lowering of the frontage roads between 22nd Street and Congress will preclude side street access to the frontage roads. This restriction will require local street connections to be reworked.

## SECTION 10. COST ESTIMATE

Separate construction cost estimates have been prepared for the elevated I-10 mainline widening project as currently designed, and for the deck park proposal. The October, 2005 cost estimate for the St. Mary's to 29th Street segment prepared by ADOT has been used for the first estimate except that it has been modified to have the same northern limit as the deck park proposal (Station 506+00). Because the St. Mary's to 29th section as currently designed starts at Station 508+00, the quantities from the southern 200 feet of the Grant to St. Mary's section have been added. The total cost for the elevated project is \$89 million based on previous work.

Similarly, the limits for the deck park proposal have been extended to 29th Street to provide results that are directly compared to the elevated project. The estimate for the deck park proposal includes amounts for contingency and design. Those costs are not included in the elevated project since it has been designed and the construction requirements well understood. Both estimates include 15% for construction administration, and both are based on October 2005 unit costs. The total cost for the deck park construction is estimated to be \$374 million or approximately \$285 million more than the current plan. The cost estimate derivation for the deck park proposal is provided in Appendix B.

## SECTION 11. THE PROCESS FORWARD

This section describes a process by which to move forward regardless of whether the deck park proposal is adopted. It identifies the general tasks leading to completion of the I-10 construction under various scenarios, and provides a preliminary schedule.

### DETAILED FEASIBILITY ANALYSIS

The purpose of the 30-day study documented here is to identify any potential "fatal flaw" technical issues that could render the deck park proposal unfeasible, and to provide the City with sufficient understanding of the costs and impacts for making a decision to proceed. Should the City choose to do so, more detailed evaluation is needed as are initial plans and reports which ADOT, FHWA and City staff can review. Specific tasks of the detailed feasibility study are anticipated to include the following:

*Preliminary Roadway Plans.* Develop plans defining in detail the proposed roadway geometrics including typical sections, plan and profile, and plotted cross-sections.

*Preliminary Structure Plans.* Develop preliminary plans showing configuration, depth, type, and sizing of major structural elements including the deck park, traffic bridges, bridges for cross-drainage structures, and retaining walls.

*Preliminary Drainage Plans.* Develop preliminary plans for pavement and cross drainage systems. Include preliminary size and configurations of pumps and air strippers if needed. Re-evaluate the capacity of Tucson Arroyo based on discharges that will exist upon completion of the Park Avenue detention system and identify need, if any, for berms or flood walls to prevent 100-year storm break-over into depressed freeway. Review FEMA mapping to confirm that the Santa Cruz River floodplain will not affect the depressed section.

*Preliminary Drainage Report.* Prepare a report documenting the hydrologic and hydraulic considerations associated with the preliminary cross-drainage and pavement drainage proposals.

*Preliminary Utility Relocation Plans.* Prepare a set of preliminary plans identifying utility impacts and proposed means of resolving them. Meet with utility owners to present initial results and receive comments and ideas. Revise approaches and plans in response to utility input as appropriate.

*Preliminary Construction Sequencing and Traffic Control Plans.* Determine in consultation with the City of Tucson and ADOT the preferable approach. Develop detailed plans showing phasing of work, detour geometrics, temporary bridges and retaining walls, and other major features found to be needed.

*Preliminary Local Circulation and Access Plans.* Work with City staff to develop a plan for circulation and access in the project area during construction. Perform traffic modeling to test the effectiveness of various approaches. Recommend a suitable approach including construction of

new or temporary roadways if appropriate. Meet with City staff to present plausible approaches and agree on a general strategy.

*Preliminary Visual Impact Mitigation Plans.* Develop preliminary landscape and artistic treatments to mitigate the visual impact of the project, and to make it fit into the context of downtown.

*Public Outreach.* Work with City staff to present the deck park proposal to and solicit input from stakeholders and general public. Prepare graphics and other handout materials. Prepare for and attend meetings including making presentations when called for.

*Cost Estimate.* Perform a more detailed quantity takeoff and cost estimate for the project based on preliminary plans and other work done under this study.

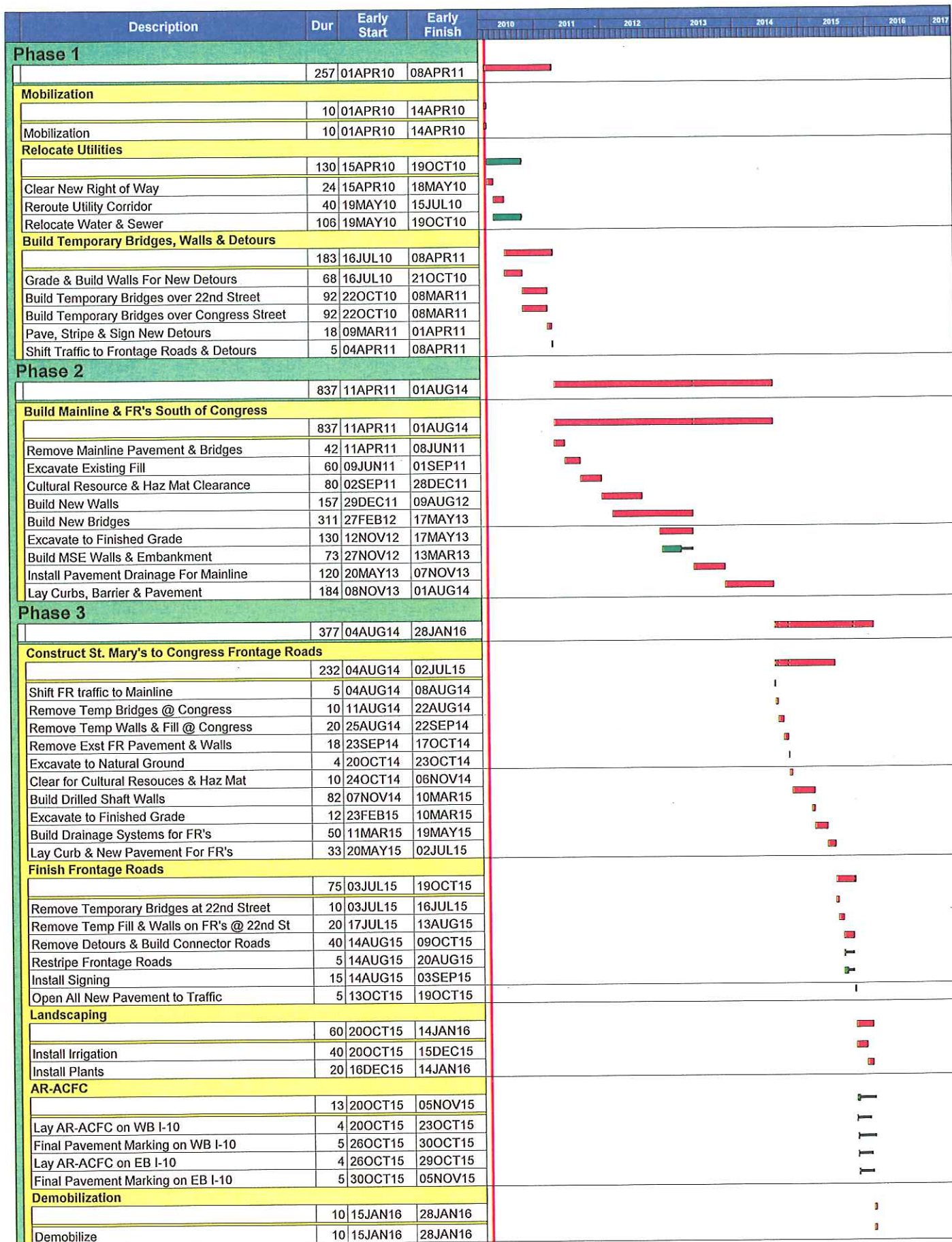
*Report.* Prepare a report documenting the results of this study. Preliminary plans will be attached as appendices. This will serve the function of a Design Concept Report though the analyses, plans, and cost estimate will be to a greater level of detail than typical for that document.

Upon completion of the detailed feasibility study, comments from ADOT, FHWA, and other stakeholders will have been received, and a more thorough understanding of project requirements will exist.

#### IMPLEMENTATION

Construction of the deck park would take 5-1/2 years to complete.

## Appendix A. Construction Schedule



Start date 01APR10  
 Finish date 28JAN16  
 Data date 01APR10  
 Run date 25JAN06  
 Must finish date 28JAN16  
 Percent complete 0  
 © Primavera Systems, Inc.

HDR Engineering, Inc.  
 I-10 Deck Park, St. Mary's to 29th  
 Construction Schedule

Early bar  
 Total float bar  
 Progress bar  
 Critical bar  
 Summary bar  
 Start milestone point  
 Finish milestone point

**Construction Schedule**  
**I-10 Deck Park, St. Mary's Road to 29th Street**

Items of Work	Quantity	Unit	Amount Per Working Day	Working Days
<b>PHASE 1</b>				
Mobilization	1	L. Sum		10
Relocate Utilities				
Clear Right of Way	12	Acre	0.5	24
Reroute Utility Corridor	2,000	LF	50	40
Relocate Sewer	10,600	LF	100	106
Relocate Water	5,400	LF	100	54
Build Detours				
Grade for New Detours	37,000	SY	3000	12
Build Temporary MSE Walls	168,000	SF	3000	56
Build Temporary Bridges over 22nd Street	9,200	SF	100	92
Build Temporary Bridges over Congress Street	9,200	SF	100	92
Pave, Sign & Stripe Detours	55,000	SY	3000	18
Shift Traffic to Frontage Roads & Detours	1	L. Sum		5
<b>PHASE 2</b>				
Build Mainline & Frontage Roads South of Congress				
Remove Mainline & Frontage Road Pavement	164,000	SY	6000	27
Remove Bridges	1	L. Sum		15
Excavate to Natural Ground	600,000	CY	10000	60
Clear For Cultural Resources & Haz Mat	1	L. Sum		80
Build Drilled Shaft Walls	157,000	SF	1000	157
Excavate Roadway	1,300,000	CY	10000	130
Build MSE Walls & Embankment	146,000	SF	2000	73
Build New Bridges	466,000	SF	1500	311
Build Pavement & Cross Drainage	1	L. Sum		120
Pour Barrier & Curbs	70,000	LF	1000	70
Lay PCCP	228,000	SY	2000	114
<b>PHASE 3</b>				
Construct St. Mary's to Congress Frontage Roads				
Shift Frontage Road Traffic to Mainline	1	L. Sum		5
Remove Temporary Bridges @ Congress Street	1	L. Sum		10
Remove Temporary Fill & Walls @ Congress Street	1	L. Sum		20
Remove Existing Frontage Road Pavement	20,000	SY	3000	7
Remove Existing Frontage Road Walls	1,100	LF	100	11
Excavate to Natural Ground	20,000	CY	5000	4
Clear For Cultural Resources & Haz Mat	1	L. Sum		10
Build Drilled Shaft Walls	82,000	SF	1000	82
Excavate Roadway	60,000	CY	5000	12
Build Drainage System for Frontage Roads	5,000	LF	100	50
Pour Curb & Gutter	10,000	LF	500	20
Lay PCCP	2,500	SY	200	13
Complete Frontage Roads				
Remove Temporary Bridges @ 22nd Street	1	L. Sum		10
Remove Temporary Fill & Walls @ 22nd Street	1	L. Sum		20
Remove Detours & Build Connector Roads	1	L. Sum		40
Restripe Frontage Roads	15,000	LF	3000	5
Install Signing	1	L. Sum		15
Open All New Pavement to Traffic	1	L. Sum		5
Landscaping				
Install Irrigation	1	L. Sum		40
Install Plants	1	L. Sum		20
<b>AR-ACFC</b>				
Lay AR-ACFC on WB-10	4200	Tons	1000	4
Final Pavement Marking on WB I-10	1	L. Sum		5
Lay AR-ACFC on EB-10	4200	Tons	1000	4
Final Pavement Marking on EB I-10	1	L. Sum		5
Demobilize	1	L. Sum		10

## Appendix B. Construction Cost Estimate

**DETAILED OPINION OF PROBABLE CONSTRUCTION COST (BASED UPON OCTOBER 2005 UNIT PRICES)**

I10 Deck Park, St Marys to 29th St

ITEM	UNIT PRICE	AS DESIGNED PROJECT QUANTITY	COST	DECK PARK PROJECT QUANTITY	COST
REMOVE STRUCTURES		1 ls	\$113,000	1 ls	\$150,000
REMOVE CURB & GUTTER	\$4 /lf	19,140 lf	\$76,560	48,108 lf	\$192,432
REMOVE SIDEWALKS & SLABS	\$3 /sf	60,545 sf	\$181,635	108,408 sf	\$325,223
REMOVE EXST BARRIER	\$9 /lf	20,468 lf	\$184,212	40,828 lf	\$367,452
REMOVE EXST BRIDGES	\$150,000 /ea	3 ea	\$450,000	7 ea	\$1,050,000
REMOVE EXST PEDESTRIAN TUNNEL	\$125,000 /ea	1 ea	\$125,000	1 ea	\$125,000
REMOVE AC PAVEMENT	\$2 /sy	15,813 sy	\$31,626	79,121 sy	\$158,241
REMOVE PCCP	\$4 /sy	97,442 sy	\$389,768	183,874 sy	\$735,494
REMOVE STORM DRAIN PIPE	\$15 /lf	12,132 lf	\$181,980	21,063 lf	\$315,945
REMOVE STORM DRAIN MANHOLE	\$500 /ea	10 ea	\$5,000	30 ea	\$15,000
REMOVE CATCH BASIN	\$400 /ea	88 ea	\$35,200	111 ea	\$44,400
REMOVE AND SALVAGE GUARDRAIL	\$3 /lf	9,731 lf	\$29,193	9,831 lf	\$29,493
REMOVE AC PAVEMENT BY MILLING	\$10 /sy	1,788 sy	\$17,880	940 sy	\$9,397
REMOVE AND SALVAGE FENCE	\$1 /lf	3,146 lf	\$3,146	9,206 lf	\$9,206
REMOVE WALL	\$30 /lf	2,842 lf	\$85,260	22,351 lf	\$670,530
REMOVALS (SUBTOTAL)			\$1,909,460		\$4,197,813
EXCAVATION	\$5 /cy	98,144 cy	\$490,720	2,282,427 cy	\$11,412,135
BORROW(REINFORCED & RETAINED BACKFILL)	\$20 /cy	226,500 cy	\$4,530,000	65,217 cy	\$1,304,340
BORROW	\$8 /cy	173,849 cy	\$1,390,792	0 cy	\$0
FURNISH WATER	\$5 /m gal	70,000 mg	\$350,000	51,000 mg	\$255,000
AGGREGATE BASE	\$40 /cy	4,780 cy	\$191,200	10,927 cy	\$437,061
GEOGRID	\$5 /sy	10,000 sy	\$50,000	10,000 sy	\$50,000
PCCP (15")	\$45 /sy	149,389 sy	\$6,722,505	149,389 sy	\$6,722,505
PCCP (11.5")	\$42 /sy	22,450 sy	\$942,900	80,292 sy	\$3,372,245
CRACK & SEAT PCCP	\$3 /sy	41,260 sy	\$123,780	12,588 sy	\$37,764
LOAD TRANSFER DOWEL ASSEMBLY	\$100 /ea	5,200 ea	\$520,000	5,200 ea	\$520,000
AC PAVEMENT	\$55 /ton	52,220 ton	\$2,851,927	78,933 ton	\$4,310,830
AR-ACFC PAVEMENT	\$88 /ton	8,330 ton	\$732,110	8,330 ton	\$732,110
CONCRETE CURB & GUTTER	\$29 /lf	10,572 lf	\$309,396	34,460 lf	\$1,008,493
CONCRETE SIDEWALK	\$4 /sf	17,815 sf	\$62,353	105,990 sf	\$370,965

**DETAILED OPINION OF PROBABLE CONSTRUCTION COST (BASED UPON OCTOBER 2005 UNIT PRICES)**

**I10 Deck Park, St Marys to 29th St**

ITEM	UNIT PRICE	AS DESIGNED PROJECT QUANTITY	COST	DECK PARK PROJECT QUANTITY	COST
CONCRETE SIDEWALK RAMPS	\$1,200 /ea	14 ea	\$16,800	30 ea	\$36,000
CONCRETE MEDIAN BARRIER & TRANS	\$70 /lf	7,087 lf	\$496,090	7,087 lf	\$496,090
CONCRETE HALF BARRIER & TRANS	\$78 /lf	24,346 lf	\$1,898,988	42,826 lf	\$3,340,428
CONCRETE GORE & MEDIAN	\$49 /sy	4,562 sy	\$222,580	7,662 sy	\$373,829
LOCAL STREET RESURFACING		1 ls	\$0	1 ls	\$2,000,000
ROADWAY (SUBTOTAL)			\$21,902,140		\$36,779,795
RETAINING WALL (CAST-IN-PLACE)	\$90 /sf	57,990 sf	\$5,219,100	27,634 sf	\$2,487,060
RETAINING WALL (MSE)	\$50 /sf	261,341 sf	\$13,067,050	229,071 sf	\$11,453,560
RETAINING WALL (DRILLED SHAFT)	\$150 /sf	0 sf	\$0	238,730 sf	\$35,809,500
NEW BRIDGES					
I10 OVER CONGRESS ST	\$121 /sf	29,237 sf	\$3,531,830		
I10 OVER CLARK STREET (3 BRIDGES)	\$141 /sf	28,293 sf	\$3,988,747		
I10 OVER 18TH STREET	\$136 /sf	20,600 sf	\$2,796,588		
I10 OVER 22ND STREET	\$114 /sf	29,237 sf	\$3,322,200	29,237 sf	\$3,322,200
CONGRESS ST OVER I10	\$170 /sf			31,590 sf	\$5,370,300
PARK DECK OVER I10	\$210 /sf			218,000 sf	\$45,780,000
PARK DECK OVER I10 (FOR CLARK STREET WASH)	\$250 /sf			16,000 sf	\$4,000,000
VENTILATION & FIRE PROT. FOR PARK DECK	\$15 /sf			234,000 sf	\$3,510,000
18TH STREET WASH OVER I10	\$250 /sf			28,000 sf	\$7,000,000
SIMPSON STREET OVER I10	\$155 /sf			16,245 sf	\$2,517,975
WB DETOUR OVER 22ND STREET	\$100 /sf			4,601 sf	\$460,100
EB DETOUR OVER 22ND STREET	\$100 /sf			4,601 sf	\$460,100
WB DETOUR OVER 22ND STREET	\$100 /sf			4,601 sf	\$460,100
EB DETOUR OVER 22ND STREET	\$100 /sf			4,601 sf	\$460,100
CLARK STREET PEDESTRIAN TUNNEL	\$599,396 /ea	1 ea	\$599,396		
STRUCTURES (SUBTOTAL)			\$32,524,911		\$123,090,995
PUMP STATION (10 cfs)	\$1,000,000 /ls			1 ls	\$1,000,000
STORAGE BASIN (17 acre-ft)	\$600 /cy			9,000 cy	\$5,400,000
BASIN EXCAVATION	\$7.50 /cy			50,000 cy	\$375,000
24" RCP (Drain to Pump)	\$115 /lf			500 lf	\$57,500

**DETAILED OPINION OF PROBABLE CONSTRUCTION COST (BASED UPON OCTOBER 2005 UNIT PRICES)**

**110 Deck Park, St Marys to 29th St**

ITEM	UNIT PRICE	AS DESIGNED PROJECT QUANTITY	COST	DECK PARK PROJECT QUANTITY	COST
GRATED CATCH BASIN	\$3,000 /ea	58 ea	\$174,000	71 ea	\$213,000
CURB OPENING CATCH BASIN & SCUPPERS	\$3,500 /ea	7 ea	\$24,500	17 ea	\$59,500
MANHOLES/JUNCTION STRUCTURES	\$6,700 /ea	25 ea	\$167,500	45 ea	\$301,500
24" SLOTTED DRAIN	\$160 /lf	2,710 lf	\$433,600	2,710 lf	\$433,600
18" RCP	\$100 /lf	843 lf	\$84,300	2,129 lf	\$212,900
24" RCP	\$115 /lf	6,099 lf	\$701,385	9,161 lf	\$1,053,515
30" RCP	\$140 /lf	16 lf	\$2,240	1,757 lf	\$245,980
12" SLEEVE	\$60 /lf	2,010 lf	\$120,600	2,010 lf	\$120,600
42" RCP	\$180 /lf	400 lf	\$72,000	400 lf	\$72,000
48" RCP	\$220 /lf	0 lf	\$0	552 lf	\$121,440
WATER TREATMENT, FMS CONNECTION, OTHER MISC				1 ls	\$1,000,000
ONSITE DRAINAGE (SUBTOTAL)				\$1,780,125	\$10,666,535
48" RCP (Franklin)	\$200 /lf	183 lf	\$36,600	0 lf	\$0
10' X 7' RCBC (Franklin)	\$1,530 /lf	0 lf	\$0	450 lf	\$688,500
36" RCP (Alameda)	\$160 /lf	225 lf	\$36,000	0 lf	\$0
72" RCP (Alameda)	\$700 /lf	0 lf	\$0	950 lf	\$665,000
60" RCP (Alameda & Congress)	\$600 /lf	0 lf	\$0	500 lf	\$300,000
20' EASEMENT (Alameda)	\$20 /sf	0 sf	\$0	19,000 sf	\$380,000
48" RCP (TCC Wash)	\$180 /lf	798 lf	\$143,640	0 lf	\$0
2-10' x 6' RCBC (Simpson Wash)	\$2,141 /lf	494 lf	\$1,057,817	0 lf	\$0
2-10' x 8' RCBC (Simpson Wash)	\$2,250 /lf	0 lf	\$0	1,000 lf	\$2,250,000
3-10' x 8' RCBC (18th Street Wash)	\$3,840 /lf	46 lf	\$176,640	0 lf	\$0
LIGHTWEIGHT CONC FILL (18th Street Wash)	\$175 /cy	3780 cy	\$661,500	0 cy	\$0
4-10' x 8' RCBC (18th Street Wash)	\$4,140 /lf	0 lf	\$0	1,700 lf	\$7,038,000
DOWNSTREAM CHANNELIZATION (Simpson Wash)	\$100 /sy	52 sy	\$5,200	0 sy	\$0
CROSS DRAINAGE (SUBTOTAL)				\$2,117,397	\$11,321,500
WATER RELOCATION		1 ls	\$318,330	1 ls	\$4,010,000
SEWER RELOCATION		1 ls	\$69,090	1 ls	\$7,440,000
UTILITY CORRIDOR RELOCATION		1 ls	\$0	1 ls	\$160,000
UTILITY RELOCATION (SUBTOTAL)				\$387,420	\$11,610,000

**DETAILED OPINION OF PROBABLE CONSTRUCTION COST (BASED UPON OCTOBER 2005 UNIT PRICES)**

**I10 Deck Park, St Marys to 29th St**

ITEM	UNIT PRICE	AS DESIGNED PROJECT		DECK PARK PROJECT	
		QUANTITY	COST	QUANTITY	COST
TRANSITION BETWEEN ST MARYS & CONGRESS		1 ls	\$0	1 ls	\$3,000,000
GRADING FOR DETOURS	\$5 /sy	Included in Earthwork		37,086 sy	\$185,428
SIGNING & STRIPING		1 ls	\$1,321,186	1 ls	\$2,000,000
LANDSCAPING		1 ls	\$783,702	1 ls	\$1,000,000
EROSION CONTROL		1 ls	\$74,180	1 ls	\$150,000
MOBILIZATION		1 ls	\$6,200,000	1 ls	\$14,000,000
HANDRAIL	\$40 /lf	3,398 lf	\$135,920	13,508 lf	\$540,320
ARTWORK & AESTHETIC TREATMENTS		1 ls	\$885,000	1 ls	\$1,000,000
CONTRACTOR QUALITY CONTROL		1 ls	\$700,000	1 ls	\$2,800,000
CONSTRUCTION SURVEY & LAYOUT		1 ls	\$500,000	1 ls	\$2,000,000
TEMPORARY NOISE WALLS		1 ls	\$0	1 ls	\$1,200,000
TEMPORARY ACCESS ROADWAYS		1 ls	\$0	1 ls	\$1,000,000
DEWATERING		1 ls	\$0	1 ls	\$4,000,000
ARCHAEOLOGICAL CLEARANCE		1 ls	\$0	1 ls	\$4,000,000
SOIL REMEDIATION		1 ls	\$0	1 ls	\$4,000,000
MISCELLANEOUS (SUBTOTAL)			\$10,599,988		\$40,875,748
RELOCATE HIGH MAST POLES, FOUNDATION, CONDUIT		1 ls	\$378,900	1 ls	\$400,000
TRAFFIC SIGNALS		1 ls	\$587,270	1 ls	\$587,270
ADVANCE SIGNALS FOR TUNNEL				1 ls	\$100,000
LIGHTING & SIGNALS (SUBTOTAL)			\$966,170		\$1,087,270
TRAFFIC CONTROL			\$4,950,637		\$10,000,000
CONTINGENCIES (20%)			\$0		\$49,925,931
SUBTOTAL			\$77,138,248		\$299,555,586
CONSTRUCTION ADMINISTRATION @ 15%			\$11,570,737		\$44,933,338
DESIGN @ 10%			\$0		\$29,955,559
TOTAL			\$88,708,986		\$374,444,483
TOTAL ROUNDED			\$88,700,000		\$374,000,000
DIFFERENCE					\$285,300,000